
**SITE CHARACTERIZATION/REMEDIAL
INVESTIGATION REPORT
AREA OF INTEREST 3**

**SUNOCO, INC. (R&M)
PHILADELPHIA REFINERY
PHILADELPHIA, PENNSYLVANIA**



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TABLE OF CONTENTS

	<u>Page No.</u>
1.0 INTRODUCTION	1
1.1 SITE HISTORY AND BACKGROUND	2
1.2 SELECTION OF COMPOUNDS OF CONCERN AND APPLICABLE STANDARDS	3
1.3 OVERVIEW OF INVESTIGATIVE FRAMEWORK AND REMEDIAL APPROACH FOR AOI 3	4
2.0 ENVIRONMENTAL SETTING	5
2.1 HISTORIC USE AND CURRENT USE.....	6
2.2 GEOLOGY	7
2.3 HYDROGEOLOGY	10
2.3.1 <i>Groundwater Occurrence and Flow</i>	10
2.4 SURFACE WATER	11
3.0 SITE CHARACTERIZATION ACTIVITIES	11
3.1 SHALLOW SOIL BORINGS AND SAMPLING	12
3.2 INSTALLATION OF GROUNDWATER MONITORING WELLS.....	12
3.2.1 <i>Shallow/Intermediate (Fill/Alluvium and Trenton Gravel) Groundwater Monitoring Wells</i>	12
3.2.2 <i>Deep (Lower Sand) Groundwater Monitoring Wells</i>	13
3.3 GROUNDWATER MONITORING	14
3.4 GROUNDWATER SAMPLING	14
3.5 LNAPL SAMPLING	14
3.6 SURVEYING ACTIVITIES	15
4.0 SITE CHARACTERIZATION ANALYTICAL RESULTS	16
4.1 SOIL ANALYTICAL RESULTS	16
4.2 GROUNDWATER RESULTS.....	16
4.3 LNAPL CHARACTERIZATION RESULTS	17
5.0 REMEDIAL SYSTEM UPDATE	18
5.1 RW-2 GROUNDWATER AND LNAPL RECOVERY SYSTEM	18
6.0 FATE AND TRANSPORT ANALYSIS	19
6.1 SOIL.....	19
6.2 GROUNDWATER	19
6.3 SURFACE WATER	20
6.4 LNAPL	21
6.5 VAPOR INTRUSION TO INDOOR AIR	21
7.0 SITE CONCEPTUAL MODEL	22
7.1 DESCRIPTION AND SITE USE	22
7.2 GEOLOGY AND HYDROGEOLOGY	23
7.3 COMPOUNDS OF CONCERN	23
7.4 LNAPL DISTRIBUTION AND LNAPL MOBILITY	24
7.5 FATE AND TRANSPORT OF COCS.....	24
7.6 POTENTIAL MIGRATION PATHWAYS AND SITE RECEPTORS	26
8.0 HUMAN HEALTH EXPOSURE ASSESSMENT/RISK ASSESSMENT	27
8.1 SURFACE WATER/SEDIMENT	28
8.2 SURFACE SOILS (0-2 FEET BELOW GRADE)	29
8.2.1 <i>Soil-to-Groundwater</i>	29

8.2.2	<i>Direct Contact Exposure</i>	29
8.3	GROUNDWATER	30
8.4	LNAPL	31
8.5	VAPOR	31
9.0	ECOLOGICAL ASSESSMENT	31
10.0	CONCLUSIONS AND RECOMMENDATIONS	32
11.0	REFERENCES	35

LIST OF TABLES

Table 1	Compounds of Concern
Table 2	Existing Well Summary
Table 3	Summary of Groundwater and LNAPL Elevations – July 2010
Table 4	Summary of Soil Sample Analytical Results – April to June 2010
Table 5	Summary of Groundwater Analytical Results: Shallow/Intermediate Monitoring Wells – July 2010
Table 6	Summary of Groundwater Analytical Results: Deep (Lower Sand) Monitoring Wells – July 2010
Table 7	Summary of April to June 2010 Soil Analytical Results Screened for Protection of Indoor Air
Table 8	Summary of July 2010 Groundwater Analytical Results Screened for Protection of Indoor Air

LIST OF FIGURES

Figure 1	Site Location Plan
Figure 2	Site Plan
Figure 3	Completed Activities Plan
Figure 4	Cross Section Location Plan
Figure 5a	Geologic Cross Section Z-Z' and B-B'
Figure 5b	Geologic Cross Section AA-AA'
Figure 5c	Geologic Cross Section XX-XX'
Figure 6	Shallow/Intermediate Groundwater Elevation Contour Plan – July 2010
Figure 7	Deep (Lower Sand) Groundwater Elevation Contour Plan – July 2010
Figure 8	Summary of Soil Sample Exceedances – April to June 2010
Figure 9	Summary of Groundwater Sample Exceedances – July 2010
Figure 10	Apparent LNAPL Thickness and Type

LIST OF APPENDICES

Appendix A	Current, Historic Use/Historic Investigation, and Impervious Surface Plan
Appendix B	Soil Boring Logs and Monitoring Well Construction Summaries
Appendix C	USGS Plate 20
Appendix D	Soil and Groundwater Analytical Reports (on CD)
Appendix E	July 2010 Groundwater Sampling Field Summary Report
Appendix F	Fate and Transport Analysis
Appendix G	Development of Site-Specific Standards and Risk Assessment
Appendix H	LNAPL Characterization Data

1.0 INTRODUCTION

Sunoco Inc. (R&M) (Sunoco) and the Pennsylvania Department of Environmental Protection (PADEP) entered into a Consent Order & Agreement (CO&A) in December 2003 with respect to Sunoco's Philadelphia Refinery (Refinery). Sunoco's Phase I Remedial Plan (Phase I Plan), dated November 2003, was included as an attachment to the CO&A. In accordance with the CO&A and Phase I Plan, a Current Conditions Report and Comprehensive Remedial Plan (CCR) was prepared by Sunoco in June 2004. The Phase I Plan and the CCR divided the facility into 11 Areas of Interest (AOIs), and presented a prioritization of the AOIs based on specific risk factors. The AOIs are shown in Figure 1 and 2 of this report. The CCR also presented the Phase II remedial approach and schedule to characterize each of the 11 AOIs, and to conduct Phase I and II corrective action activities in accordance with the 2003 CO&A and the Phase I Plan. Since 2003, Sunoco has completed site characterization activities at six AOIs (AOIs 1, 4, 5, 6, 8 and 9). For each AOI that has been characterized, Sunoco has prepared and submitted a corresponding Site Characterization Report in accordance with the Revised Phase II Corrective Action Activities schedule that was included in the CCR. Based on the Phase II Corrective Action Activities Schedule, AOI 3 along with AOI 2 and AOI 7, were identified by Sunoco to be investigated in 2010.

In April 2004, the PADEP and the United States Environmental Protection Agency (EPA) signed an agreement entitled "One Cleanup Program Memorandum of Agreement (PA One Cleanup Program)," which clarifies how sites remediated under Pennsylvania's Land Recycling and Environmental Remediation Standards Act (Act 2) program may satisfy EPA's Resource, Conservation and Recovery Act (RCRA) corrective action requirements through characterization and attainment of Act 2 remediation standards. Since November 2005, Sunoco and its representatives have met with officials of the PADEP and EPA on several occasions to discuss the applicability of PA One Cleanup Program to the ongoing remedial program for the facility. Sunoco, PADEP and EPA agreed that the ongoing remedial program can be addressed under the PA One Cleanup Program. Sunoco submitted a Notice of Intent to Remediate (NIR) on October 12, 2006 to formally enter the facility into the PA Act 2 Program. The portion of the Refinery known as the Belmont Terminal was not included in the NIR. A NIR may be submitted in the future for the Belmont Terminal. The cover letter included with the NIR expressed Sunoco's intent to enter the facility into the PA One Cleanup Program. To date, acknowledgement of formal acceptance into the PA One Cleanup Program has not been

received by EPA; however, the facility is listed on EPA's online PA One Cleanup Program list and is therefore considered to be in the PA One Cleanup Program

Sunoco prepared a site characterization work plan (Work Plan) for AOI 3 on March 19, 2010 and submitted the work plan to the PADEP and EPA. This Work Plan summarized proposed activities to be completed to characterize AOI 3 in accordance with the objectives of the CCR.

This Site Characterization/Remedial Investigation Report (SCR/RIR) has been prepared exclusively for AOI 3 and documents the results of the characterization activities completed in accordance with the Work Plan. The objective of this SCR/RIR is to document current environmental conditions at AOI 3 in accordance with the 2003 CO&A, the 2004 CCR and to evaluate whether the remedial objectives of the CO&A are being met based on the current conditions.

1.1 Site History and Background

The Sunoco Philadelphia Refinery is located in southwest Philadelphia. The facility has a long history of petroleum transportation, storage, and processing. The oldest portion of the facility started petroleum related activities in the 1860's, when the Atlantic Refining Company established an oil distribution center. In the 1900's, crude oil processing began and full-scale gasoline production was initiated during World War II. In addition to refining crude oil, various chemicals, such as acids and ammonia, were also produced at the site for a time. Current operations at the Refinery are limited to the production of fuels and basic petrochemicals for the chemical industry.

AOI 3, also known as the Impoundment Area is located on the east side of the Schuylkill River. AOI 3 is bordered by Hartranft Street to the north, AOI 4 to the east, Penrose Avenue to the south, AOI 7 to the southwest, and the Schuylkill River to the northwest (Figures 1 and 2). AOI 3 encompasses approximately 104 acres and the majority of AOI 3 is not covered by impervious surfaces. Currently, AOI 3 is comprised of the #5 Tank Farm, Guard Basin, Four Pond Area, three past disposal areas (PDAs), former Chevron Ballfields, contractor parking lot, operating bundle cleaning area and South Flare, contractor office trailer yard, Central Warehouse, and a guard shack is located along River Road. The current, historic uses/investigations and approximate limits of impervious surfaces of AOI 3 are described on Figure A-1 provided in Appendix A.

Numerous controls that prevent direct contact to subsurface soil and groundwater (i.e. permits for excavation, Occupation Safety and Health Administration (OSHA) restrictions, etc.) apply to AOI 3. These controls prevent exposure to site COCs as listed in Table 1. Prior to any work being completed within AOI 3, appropriate work permits, safety and security measures, etc must be approved by Refinery personnel. Operating areas of AOI 3 are located within a fenced, secured area to prevent unauthorized access. Direct contact to deeper site soils (soils greater than two feet beneath the ground surface) is prevented by Sunoco's on-site procedures and personal protective equipment (PPE) requirements.

The existing monitoring well network in AOI 3 includes a total of 39 accessible existing monitoring wells and 11 new monitoring wells which were recently installed as part of the site characterization effort. A well construction summary of AOI 3 monitoring wells is included in Table 2. There is one remediation system in AOI 3 which includes the RW-2 Groundwater and LNAPL Recovery System. This system recovered product in the area of RW-2 and is currently turned off pending conclusions and recommendations of this report. Groundwater gauging of select monitoring wells in AOI 3 occurs on an annual basis during the second or third quarter of each year. Annual gauging activities and results are reported to the PADEP and EPA in Quarterly Reports prepared by Sunoco. The annual gauging data was used in AOI 3 Work Plan and this report to evaluate groundwater flow direction and LNAPL occurrence.

1.2 Selection of Compounds of Concern and Applicable Standards

The compounds of concern (COCs) for soil and groundwater are listed in Table 1 of this report. The COCs include all current constituents from the PA Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E of the PADEP's Closure Requirements for Underground Storage Tank Systems, with the exception of select waste oil constituents. These COCs are the same as those listed in the Work Plan and only differ from those listed in the CCR based on the addition of two compounds: 1,2,4-trimethylbenzene (TMB) and 1,3,5-trimethylbenzene (TMB). These two compounds were added to the list of COCs based on PADEP's recent revisions to the Petroleum Short List of Compounds. The following

sections describe the applicable standards that were used in evaluating the site characterization data.

Soil

Surface (0-2 feet) soil samples were collected at each soil boring/well location that represents a potential complete direct contact exposure pathway to site workers (e.g., unpaved area). These surface soil results were screened against the PADEP non-residential statewide health soil medium-specific concentrations (MSCs). As summarized in the CCR, where these MSCs are exceeded, Sunoco evaluated application of the site-specific remediation standard using either the pathway elimination or calculated risk-based standard options.

Groundwater

Groundwater sample results were screened against the PADEP non-residential, used-aquifer (TDS<2,500) statewide health groundwater MSCs. Attainment of one or more of the Act 2 remediation standards (statewide, site-specific and/or background) will be demonstrated for groundwater at the downgradient facility boundary. Site-specific remediation standards may be achieved using a pathway elimination demonstration or calculated risk-based standards.

1.3 Overview of Investigative Framework and Remedial Approach for AOI 3

The current remediation program for the Refinery is performed under the 2003 CO&A between PADEP and Sunoco. In April 2004, the PADEP and EPA signed an agreement entitled "One Cleanup Program Memorandum of Agreement (MOA or One-Cleanup Program)," which clarifies how sites remediated under Pennsylvania's Act 2 program may satisfy RCRA corrective action requirements through characterization and attainment of Act 2 remediation standards pursuant to Pennsylvania's Act 2. On November 22, 2005, Sunoco and its representatives met with officials of the PADEP and EPA to discuss the applicability of the Sunoco Philadelphia Refinery to the One Cleanup Program. During the November 22, 2005 meeting, all parties agreed that the One Cleanup Program would benefit the project by merging the remediation obligations under the various programs into one streamlined approach which would be conducted under the existing 2003 CO&A.

As a follow up to the November 22, 2005 meeting, Sunoco submitted a letter dated December 2, 2005 to EPA and PADEP documenting the discussions at the meeting. Sunoco submitted a Notice of Intent to Remediate (NIR) for the Refinery, excluding the Belmont Terminal, to the PADEP on October 12, 2006 and held a public involvement meeting in South Philadelphia on September 19, 2007. On March 5, 2009, Sunoco and its representatives met again with EPA to discuss Sunoco Philadelphia Refinery's remediation progress and path forward under the One Clean-Up Program. As a follow up to the meeting, Sunoco submitted a letter dated March 11, 2009 to EPA and PADEP documenting the discussions at the meeting. The major points of this letter are below:

- US EPA will provide a formal letter that acknowledges that there is a One Clean Up Program Agreement with Sunoco and is currently operating under one US EPA ID Number (PAD049791098) for Point Breeze, Girard Point and Schuylkill River Tank Farm;
- US EPA will add in a Corrective Action Module to the Sunoco-submitted Draft Part B RCRA Permit. The module will reference the One Clean-Up Program agreement and the current remediation work being completed under the existing Consent Order and Agreement between PADEP and Sunoco, Inc.; and
- US EPA will issue a letter to Sunoco for each characterized SWMU that lists a non-leaded tank bottom designation for which no further action is required.

The Guard Basin is listed as SWMU #3 pursuant to EPA's corrective action program in the 1992 RCRA Facility Investigation (RFI) report and is the only SWMU in AOI 3. Characterization activities completed at SWMU 3 are presented in this report.

2.0 ENVIRONMENTAL SETTING

AOI 3 is bordered by Hartranft Street to the north, AOI 4 to the east, Penrose Avenue to the south, AOI 7 to the southwest, and the Schuylkill River to the northwest (Figures 1 and 2). AOI 3 encompasses approximately 104 acres.

2.1 Historic Use and Current Use

Sunoco obtained available historical aerial photographs with coverage of AOI 3 from the City of Philadelphia Library and reviewed them to identify specific areas for characterization and to assist in determining previous uses of AOI 3. Aerial photos were reviewed for the following years: 1930, 1945, 1959, 1965, 1970, 1975, 1980, 1985, 1990, 1995 and 2005. A brief summary of each photograph was provided in the AOI 3 Work Plan that was submitted to PADEP and EPA on March 19, 2010. The historic and current uses of AOI 3 are described in the following paragraphs.

Currently, AOI 3 is comprised of the #5 Tank Farm, Guard Basin, Four Pond Area, three PDAs, former Chevron Ballfields, contractor parking lot, operating bundle cleaning area, South Flare, contractor office trailer yard, Central Warehouse, and guard shack at the entrance to the Refinery along River Road.

The #5 Tank Farm consists of six aboveground storage tanks (ASTs) and is the northernmost feature within AOI 3. The tanks store intermediate, light, and chemical fluids. Two of the aboveground tanks were taken out of service and are currently being closed under the tank program.

The Guard Basin/Four Pond area is an unlined stormwater retention pond system located in the southeastern portion of AOI 3. The Guard Basin has been in operation since prior to the 1950s as a stormwater retention basin. The Four Pond area located to the west of the Guard Basin was constructed in the mid to late 1980s. Currently channeled stormwater from the south yard of the Refinery passes through a grit chamber into the stormwater retention pond system. Under dry weather conditions, stormwater is pumped to the Point Breeze wastewater treatment plant. During wet weather conditions, the water passes through the grit chamber to an oil-water separator before discharging to the Guard Basin. The grit chamber and oil-water separator were designed as a barrier for migration of potential contaminant releases to local surface water. Water is pumped from the ponds either to the Refinery's on-site wastewater treatment plant or, during emergencies, passes through the basin and is discharged to the Schuylkill River. Discharge to the river is regulated under the Refinery's NPDES permit #PA0012629 A1 via Outfall #004.

The Guard Basin is listed as SWMU #3 pursuant to EPA's corrective action program in the 1992 RCRA Facility Investigation (RFI) report by ENSR. Extensive investigation of the Guard Basin was completed as part of the RFI. The results of the RFI indicated that there were no unacceptable risks posed by soil or sediments in the Guard Basin, and because the Lower Sand unit beneath the Guard Basin is not used as a source of potable water, the benzene concentrations detected in this unit also posed no unacceptable risk. Several reportedly capped PDAs are located immediately east of the Guard Basin (RFI, 1992). These PDAs were not considered directly part of SWMU #3 although the Guard Basin was considered the main location where contaminants from the PDAs would discharge. These areas reportedly accepted various Refinery waste including leaded and cooling tower sludges.

The Former Chevron Ballfield area is an open, unimproved area located in the central portion of AOI 3 that formerly consisted of two baseball diamonds used by Chevron employees from approximately 1970-1992. Two areas were identified in the Ballfield Area which contained impacted soil from former waste disposal practices (A. T. Kearney, 1989). Prior to that, the area was owned by the Union Tank Car company from the 1940's to the 1970's and contained railroad sidings where tank cars were cleaned (Dames & Moore 1993). Located to north of the ballfield area is the contractor parking lot, contractor office trailer yard, Central Warehouse, and a guard shack located along River Road.

The current, historic uses/investigations and approximate limits of impervious surfaces of AOI 3 are depicted on Figure A-1 provided in Appendix A.

2.2 Geology

To further characterize geology beneath AOI 3, Sunoco advanced nine fill/alluvium, and Trenton Gravel (shallow/intermediate) monitoring wells to depths ranging from 15 to 25 feet below ground surface (ft bgs). Two deep (Lower Sand) monitoring wells were also installed to depths of 61 and 78 ft bgs. Soils were continually logged at each well location. Copies of the boring/well construction logs are included as Appendix B.

To illustrate the geology at AOI 3, four geologic cross sections (Figures 5a, 5b, and 5c) trending north-south and east-west were prepared using historic and recently

completed soil boring/well logs. The cross section locations are shown in plan view in Figure 4.

The following paragraphs describe the geologic units relevant to AOI 3 beginning with the deepest units to the shallowest units:

Wissahickon Formation – Bedrock beneath the Refinery and AOI 3 is identified as the Wissahickon Schist. This formation is a metamorphosed greenish-gray micaceous schist and quartzite. The competent bedrock of the Wissahickon Formation is overlain by weathered bedrock consisting of micaceous clay, which becomes increasingly sandy as the degree of weathering lessens and competent bedrock is encountered. Based on historic and recent deep monitoring wells and soil borings completed in AOI 3, the Wissahickon Schist is located approximately 85 and 95 ft bgs. The bedrock depth is illustrated in Figures 5a, 5b, and 5c.

Middle/Lower Sand Units of the PRM – Throughout the majority of the Refinery, the Wissahickon Formation is overlain by the Middle/Lower Sand, which is the lowest member of the Potomac-Raritan Magothy (PRM) Aquifer System. As shown in Figures 5a, 5b, and 5c, the Lower Sand overlies bedrock throughout AOI 3. A total of two deep (Lower Sand) monitoring wells (S-280D and S-284D) were installed in AOI 3 as part of the site characterization activities. The purpose of the additional deep (Lower Sand) monitoring wells was to obtain geologic information to refine the site conceptual model and obtain groundwater quality data for the Lower Sand. Based on interpretation of the geology as shown in Figures 5a, 5b, and 5c all deep wells in AOI 3 are screened in the Lower Sand where the Lower/Middle Clay is present.

The Lower Sand beneath AOI 3 generally consist of a brown, orange and/or red, fine to course gravel and fine to course sand that grades upward into medium-to-fine sands and contains layers of silts and clay. The Lower Sand in the northern and southern portions of AOI 3 is located at approximately 60 to 95 feet bgs. The Lower Sand in the central portion of AOI 3 is located at approximately 10 to 30 ft bgs. The Middle Sand unit was observed in the newly installed deep well S-280D between 46 to 62 ft bgs and in S-284D between 26 to 32 ft bgs.

Middle/Lower Clay – The Middle/Lower Clay in AOI 3 is characterized by very low permeability reddish-brown, brown or gray clays, sandy clays, with trace amounts of organic matter. The Lower/Middle Clay overlies the Middle/Lower Sand throughout most of AOI 3. In the northern portion of AOI 3, the Lower/Middle clay is located between 30 and 70 ft bgs. In the central portion of AOI 3, the Lower/Middle Clay inter-fingers with the Lower Sand. In the southern portion of AOI 3, the Lower/Middle Clay is located between 45 and 60 ft bgs. The USGS (USGS, 1961) interpreted that a depositional trough is located near AOI 3 and notes that, near the heads of these troughs of deposition, the clay members have been removed. The extent of the clay beneath AOI 3 is generally consistent with the extent illustrated by USGS (USGS, 1961). Plate 20 of the USGS publication includes a geologic cross section of the coastal plain deposits near AOI 3. This plate is provided in Appendix C of this report.

Trenton Gravel – Throughout most of the Refinery, the Trenton Gravel typically overlies the Middle/Lower Clay and Lower Sand with thicknesses up to 80 feet and a typical thickness of 40 feet. The Trenton Gravel is of Pleistocene Age (Ice Age; less than 2 million years) and is a very heterogeneous unit comprised of a predominant brown to gray sand, gravel and minor amounts of clay (Owens and Minard, 1979). As shown in Figures 5a, 5b, and 5c, the Trenton Gravel is differentiated from the fill/alluvium in AOI 3. In northern and central portions of AOI 3, the Trenton Gravel is located at 10 to 40 ft bgs. In the southern portion of AOI 3, the Trenton Gravel is located at 10 to 50 ft bgs.

A total of nine monitoring wells were advanced into the fill/alluvium and Trenton Gravel as part of the recent site characterization activities.

Recent Fill/Alluvium - Fill material in AOI 3 generally consists of various sands and gravels, silty clay, cinder ash, brick, wood, and glass. The alluvium deposits in AOI 3 generally consist of dark brown, gray and black silts and sands, with trace amounts of silty clay. As shown in Figures 5a, 5b, and 5c, fill/alluvium deposits exist throughout AOI 3 and range in thickness between 5 and 20 feet.

In addition to the above descriptions, the following general observations can be made concerning the geology in AOI 3:

- The depth to bedrock beneath AOI 3 is estimated to be approximately 85 to 95 ft bgs. This depth to bedrock is consistent with previous geologic cross sections prepared by Dames & Moore and with the USGS's interpretation (USGS, 1961);
- The Lower Sand overlies bedrock throughout AOI 3 and is generally shallower in the central portion of AOI 3;
- In the central portion of AOI 3, the Middle/Lower Clay inter-fingers with the Lower/Middle Sand;
- Trenton Gravel is differentiated from the fill/alluvium throughout AOI 3 and ranges in thickness between 10 to 50 feet; and
- The fill/alluvium materials are present throughout AOI 3 ranging in thickness between 5 to 20 feet.

2.3 Hydrogeology

2.3.1 Groundwater Occurrence and Flow

Groundwater gauging data collected by Stantec Consulting, Inc. (Stantec) in July 2010 was used to generate groundwater flow maps for AOI 3. The groundwater elevation data from this gauging event is provided in Table 3. Well construction details for these monitoring wells are provided in Table 2 and boring/well construction logs for the newly installed wells are provided in Appendix B of this report. Historic boring/well logs for wells installed prior to the site characterization activities were provided in Appendix D of the CCR.

Groundwater flow within AOI 3 is described below:

- Two sets of groundwater contours were created using groundwater elevations from both shallow/intermediate and deep (Lower Sand) wells (Figures 6 and 7).
- In the central portion of AOI 3, the Lower/Middle Clay is shallower in depth and inter-fingers with the Lower/Middle Sand. Shallow/intermediate groundwater elevations in this area are generally lower in elevation. Beneath the clay, a partially-confined or confined aquifer exists in the Lower Sand.

- Groundwater flow in the fill/alluvium/Trenton Gravel in the northern portion of AOI 3 is to the south-southeast and in the central and northern portions to the east-northeast. The hydraulic gradient in the fill/alluvium and Trenton Gravel ranged from 0.0001 to 0.0091 with an average of 0.003. The highest value of the hydraulic gradients in the fill/alluvium and Trenton Gravel, is in the southern area of AOI 3 (PDA area), and seems to be due to an isolated perched groundwater zone.
- Shallow (fill/alluvium) wells located in the southeast portion of AOI 3 near the Guard Basin in the PDA area show evidence of a perched water table. Because of these conditions, separate groundwater contours were created for this area to better represent the perched groundwater conditions.
- Groundwater flow in the Lower Sand is generally towards the east-southeast in AOI 3. The value of the hydraulic gradient in the Lower Sand aquifer ranges from 0.0002 to 0.006, with an average of 0.002. The highest value of the hydraulic gradients in the Lower Sand aquifer, is in the southwestern area of AOI 3 (near the Schuylkill River), and could be due to a higher bedrock elevation in this area.

2.4 Surface Water

The Schuylkill River defines the northwestern border of AOI 3. The Guard Basin/Four Pond areas are other surface water bodies along the eastern extent of AOI 3. These basins/ponds handle permitted stormwater for the refinery and are not considered to be surface water receptors.

3.0 SITE CHARACTERIZATION ACTIVITIES

The following sections summarize the site characterization activities that were completed in AOI 3 in support of this SCR/RIR. Site characterization activities were performed between April and July 2010 by Aquaterra under the direction of Sunoco and Langan. These activities were executed in accordance with the Work Plan.

3.1 Shallow Soil Borings and Sampling

A total of 12 shallow (0-2 ft bgs) soil samples were collected for analysis of site COCs from areas within AOI 3 and one shallow soil sample from the western boundary of AOI 4. Shallow soil samples were collected from four soil borings and from eight monitoring well locations from unpaved areas. The locations of all soil borings and soil samples collected are shown on Figure 3. All soil samples were collected utilizing split spoon sampling techniques. Boring logs depicting lithology at each soil boring location are provided as Appendix B.

Soil samples were submitted to Lancaster Laboratories, Inc. (LLI) of Lancaster, Pennsylvania for analysis of site COCs. A summary of the soil analytical results screened against the PADEP non-residential soil MSCs is provided as Table 4 and the results are discussed in Section 4.1. A summary of samples with concentrations above the non-residential soil MSC are illustrated on Figure 8. The laboratory analytical reports are provided as Appendix D.

3.2 Installation of Groundwater Monitoring Wells

Well installation activities were performed between April and July 2010 by Parrat Wolff, Inc. (PWI) of East Syracuse, New York, Total Quality Drilling (TQD) of Mullica Hill, NJ and East Coast Drilling (ECDI) of Moorestown, NJ under the direct supervision of Aquaterra and Langan. The locations of all monitoring wells installed are shown on Figure 3. Monitoring wells were installed to monitor the water table aquifer above the clay (fill/alluvium, and Trenton Gravel) and the deep aquifer (Lower Sand) beneath the clay. Monitoring wells were installed and constructed in accordance with the Work Plan. The well installation activities are discussed in the following sections.

3.2.1 Shallow/Intermediate (Fill/Alluvium and Trenton Gravel) Groundwater Monitoring Wells

Aquaterra and Langan provided direction and oversight to PWI and TQD to install 8 shallow/intermediate groundwater monitoring wells in AOI 3. One shallow/intermediate groundwater monitoring well was installed along the western boundary of AOI 4.

Prior to the installation of shallow/intermediate monitoring wells, each well location was cleared for subsurface utilities to a depth of 8 to 10 ft bgs with a hydro-excavator. Shallow/intermediate wells were advanced utilizing hollow stem augers and split spoon samplers to record lithology. Split spoon samples were collected at various intervals throughout the borings typically starting at 8 to 10 ft bgs. Where shallow soil samples were collected, split spoon samples (from 0-2 ft bgs) were advanced alongside the cleared drill hole location. Shallow/intermediate monitoring wells were constructed to a maximum depth of 25 ft bgs with the screen intervals ranging from 10 to 15 feet.

Monitoring wells were constructed with either a flush mount manhole cover or with a stickup protective steel casing. Well construction details are provided in Table 2. Boring logs depicting monitoring well construction details and lithology are provided as Appendix B.

Following well construction, the monitoring wells were developed in accordance with the Work Plan.

3.2.2 Deep (Lower Sand) Groundwater Monitoring Wells

Six deep (Lower Sand) groundwater monitoring wells had existed in AOI 3 prior to the recent site characterization activities. Aquaterra and Langan provided direction and oversight to ECD to install two new Lower Sand monitoring wells (S-280D and S-284D) in AOI 3.

Prior to the installation of deep monitoring wells, each well location was cleared for subsurface utilities to a depth of 8 to 10 ft bgs with a hydro-excavator. Deep wells were advanced by ECD utilizing hollow stem auger and mud rotary drilling, and split spoon samplers to record lithology. The two deep wells were advanced to 61 and 78 ft bgs with screen intervals of 15 feet in the Lower Sand. Well construction details are provided in Table 2 and soil boring/well construction logs are provided in Appendix B. Geologic information obtained from the deep soil borings completed in AOI 3 was used to prepare geologic cross sections provided as Figures 5a, 5b, and 5c.

3.3 Groundwater Monitoring

On July 13, 2010, Stantec performed monitoring well gauging activities to collect liquid levels from shallow/intermediate and deep monitoring wells in AOI 3. A total of 45 accessible monitoring wells were gauged for depth-to-water, and if applicable, depth-to-product in accordance with the Work Plan. All well gauging readings are summarized in Table 3.

The groundwater monitoring data from Table 3 was used to generate groundwater contour maps provided as Figures 6 and 7.

3.4 Groundwater Sampling

In July 2010, Aquaterra performed a complete round of groundwater sampling from 37 accessible monitoring wells in AOI 3. All groundwater sampling activities were completed in accordance with the Work Plan. The monitoring well sampling summary data sheets are provided as Appendix E.

Following well purging activities, groundwater samples were collected by lowering a disposable bailer slowly into the monitoring well to minimize excess agitation. The bailer was filled with water from the top of the water table and retrieved. Samples were then collected in laboratory-prepared bottleware and immediately placed on ice. Samples were submitted to LLI for analysis of site COCs. Once the sample was collected, the bailer, bailer cord, and nitrile gloves used to obtain the sample were discarded. Sample date, time, number, and site name were recorded on the chain-of-custody and in field books. Groundwater samples analyzed for dissolved lead were filtered by LLI at the lab.

The groundwater analytical results for shallow/intermediate wells are presented in Table 5. The groundwater analytical results for the deep wells are presented in Table 6. The laboratory analytical reports are included as Appendix D.

3.5 LNAPL Sampling

During the July 2010 gauging event for AOI 3, five monitoring wells (S-113, S-19, S-59, S-60, and S-285) and one recovery well (RW-2) in AOI 3 had measurable (greater than

0.01 feet) light non-aqueous phase liquid (LNAPL). LNAPL was also observed in S-282, which was a new well installed along the western boundary of AOI 4. LNAPL samples from monitoring wells S-59 and S-60 were previously collected and characterized as part of the CCR. LNAPL samples were also previously collected from monitoring wells S-21, S-68, BH-106, and BF-107 as part of the CCR. During the July 2010 gauging event, LNAPL was not measured in these wells and S-68 no longer exists. Stantec collected LNAPL samples from the two newly installed wells (S-282 and S-285) for LNAPL characterization. LNAPL samples were collected using a direct sampling method in accordance with the Work Plan. LNAPL samples were packaged in certified hazardous material shipping boxes and shipped to Torkelson Laboratories (Torkelson) of Tulsa, Oklahoma for LNAPL characterization. LNAPL characterization data included product types, density, proportions of product, degree of weathering, and similarities to other LNAPL samples collected at the Refinery.

The monitoring wells with current measurable LNAPL were characterized by Torkelson as follows: S-59 is 60% Gasoline and 40% Middle Distillate; S-60 is 80% aviation gasoline and 20% middle distillate; S-282 is 70% middle distillate, 20% aviation gasoline and 10% heavier material; and S-285 is 80% middle distillate, 20% heavier material and 10% unknown light material. Appendix H summarizes the LNAPL characterization results from the CCR and the recent site characterization activities and also includes laboratory data packages.

3.6 Surveying Activities

Following completion of well installation and soil boring activities, the newly installed monitoring wells and soil boring locations were surveyed by Langan to establish the location and elevation of the inner and outer casing and ground surface at each point. All well elevations were determined to the nearest 0.01 foot relative to mean sea level. All survey activities were performed by a Pennsylvania-licensed surveyor and tied to the NAVD 88 datum. The new survey data for the monitoring wells is presented in Table 3. This new survey data was used to update the Geographic Information System (GIS) and site wide database for the Refinery.

4.0 SITE CHARACTERIZATION ANALYTICAL RESULTS

The following sections discuss the analytical results of the site characterization activities performed in AOI 3.

4.1 Soil Analytical Results

The analytical results of the soil samples collected in AOI 3 are provided in Table 4. All of the soil samples were collected between the ground surface and two ft bgs and no saturated soils were observed at these depths. The soil sample results were screened against the PADEP non-residential soil MSCs. Soil sample locations with results above their respective soil MSCs are shown in Figure 8.

COCs detected in soil at concentrations above their respective non-residential soil MSCs included the following:

- BH-10-01_1-2 – benzene (1,200 ug/kg);
- BH-10-02_1-2 – lead (5,540 mg/kg); and
- S-185_1-2 – lead (536 mg/kg).

1,2-dichloroethane, 1,2,4-TMB, 1,3,5-TMB, cumene, ethylbenzene, ethylene dibromide, methyl tert-butyl ether (MTBE), toluene, xylenes, anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluorene, naphthalene, phenanthrene and pyrene were not detected in AOI 3 soil samples at concentrations above their respective non-residential soil MSCs.

4.2 Groundwater Results

The results of the groundwater samples collected from monitoring wells in AOI 3 are provided in Tables 5 and 6. The results were screened against the PADEP non-residential used aquifer (TDS<2,500) groundwater MSCs. Locations with concentrations above the groundwater MSCs are illustrated in Figure 9. A summary of the COC concentrations that exceeded the PADEP non-residential groundwater MSCs are presented below:

Shallow/Intermediate Wells

COCs detected in shallow/intermediate wells at concentrations above their respective non-residential groundwater MSCs included the following:

- S-280 – benzene (41,000 ug/L) and toluene (6,900 ug/L);
- S-281 – 1,2,4-TMB (1,200 ug/L) and 1,3,5-TMB (520 ug/L);
- BF-106 – 1,2,4-TMB (130 ug/L) and benzene (130 ug/L);
- S-288 – 1,2,4-TMB (47 ug/L) and benzene (280 ug/L);
- S-16 – 1,2,4-TMB (400 ug/L), 1,3,5-TMB (140 ug/L), benzene (220 ug/L), and MTBE (40 ug/L);
- S-20 – MTBE (97 ug/L); and
- S-23 1,2,4-TMB (51 ug/L).

Deep (Lower Sand) Wells

COCs detected in deep wells at concentrations above their respective non-residential groundwater MSCs included the following:

- BF-108 – MTBE (120 ug/L); and
- S-22 – benzene (6 ug/L) and MTBE (48 ug/L).

4.3 LNAPL Characterization Results

On July 2010, Stantec gauged 45 accessible wells in AOI 3, and observed five monitoring wells (S-19, S-59, S-60, S-113, and S-285) and one recovery well (RW-2) with LNAPL. LNAPL was also observed in S-282, which was a new well installed along the western boundary of AOI 4. The thickness of the LNAPL ranged from 0.02 to 0.84 feet.

The previous LNAPL characterization data for AOI 3, obtained as part of the CCR, is provided in Appendix H. Two new monitoring wells (S-282 and S-285) installed as part of the site characterization activities contained measurable LNAPL. Based on the LNAPL characterization performed by Torkelson during the CCR and recent site characterization activities, there are three LNAPL mixtures in AOI 3. These

include: gasoline/middle distillate, middle distillate, and residual oil. The locations of wells with measurable LNAPL and the type of LNAPL are shown on Figure 10.

Monitoring well S-282, which was installed along the western boundary of AOI 4, indicated a different product type (middle distillate), than the product typed at S-59 and S-60 (gas middle distillate). Product identified in S-282 appears to be associated with a separate plume stemming from AOI 4. LNAPL modeling, using the API model was completed as part of the 2004 CCR to evaluate specific volume and LNAPL mobility for product in some of these wells. Based on the LNAPL type, absence of LNAPL in the surrounding monitoring wells, groundwater flow direction, and the LNAPL modeling performed as part of the CCR, indicates that LNAPL in these wells is stable and immobile. Therefore, no additional LNAPL modeling was completed as part of this SCR/RIR.

5.0 REMEDIAL SYSTEM UPDATE

5.1 RW-2 Groundwater and LNAPL Recovery System

The RW-2 Groundwater and LNAPL Recovery System is the only installed remediation system in AOI 3. The RW-2 Groundwater and LNAPL Recovery System is a dual pumping system consisting of separate electric submersible pumps for groundwater and LNAPL recovery. Both pumps are equipped with density-driven floats that control the respective pumps based on liquid levels in the well. Recovered groundwater is pumped to the Point Breeze Processing Area Wastewater Treatment Plant. Recovered LNAPL is stored in an 8,000-gallon holding tank that is periodically pumped out and the contents recycled by the Refinery.

The RW-2 Recovery System was taken temporarily out of service on July 1, 2009 and was offline while the evaluation of the system was completed as part of the site characterization activities. Given the limited occurrence and mobility of the LNAPL observed in RW-2, the recovery system will remain off-line. The recovery system wells will be monitored quarterly and results reported in the Quarterly Reports prepared by Sunoco.

6.0 FATE AND TRANSPORT ANALYSIS

The following sections describe fate and transport modeling activities performed as part of AOI 3 site characterization.

6.1 Soil

No fate and transport modeling was completed for the soil analytical results since the only potential exposure pathway to shallow soil is by direct contact. The soil-to-groundwater pathway is evaluated through evaluation of groundwater data. Potential exposure pathways for AOI 3 are discussed in detail in Section 8.0.

6.2 Groundwater

Fate and transport modeling was completed for all wells that exhibited concentrations of COCs above their respective PADEP non-residential groundwater MSCs in AOI 3. This modeling approach is considered a worst case scenario and did not account for actual groundwater flow conditions. Results of the July 2010 groundwater sampling indicated seven shallow/intermediate wells (BF-106, S-16, S-20, S-23, S-280, S-281, and S-288) and two deep wells (BF-108 and S-22) in AOI 3 exhibiting concentrations of groundwater COCs above their respective groundwater MSCs. Due to the proximity of the western and eastern AOI 3 site boundary to many of these sampled locations, the potential for off-site migration from AOI 3 was evaluated by fate and transport modeling using the Quick Domenico (QD) model. The fate and transport modeling was completed to evaluate whether the groundwater conditions above MSCs would reach either the boundary of the Refinery or the Schuylkill River. The QD Version 2 spreadsheet model and either PADEP default or site-specific data were used to perform the fate and transport calculations.

Input and result summary spreadsheets for each monitoring well modeled are included in Appendix F (Tables F.1 through F.9). A comparison between the model-predicted downgradient transport distance and the distance to the nearest property boundary is also included in these tables.

The following summaries the results of the QD simulations:

- The modeling results indicate that concentrations above the MSC in shallow/intermediate wells BF-106, S-16, S-20, S-23, S-281, S-288, S-280, and in deep wells BF-108 and S-22 are not predicted to migrate beyond the AOI 3 boundary.
- The modeling results indicate that two monitoring wells (S-281 and S-288) contain concentrations of VOCs (1,2,4-TMB and 1,3,5-TMB in S-281 and benzene in S-288) that have the potential to reach the AOI-3 boundary and migrate into AOI 4. Based on the QD simulations, groundwater concentrations in exceedance of the MSC will not reach the Refinery boundary, located along the eastern boundary of AOI 4.
- The modeling results for benzene in S-280 were predicted not to attenuate to a concentration below its groundwater MSC by the time it reaches the AOI 3 western boundary (Schuylkill River). The QD model predicts the benzene concentration adjacent to the Schuylkill River (285 feet away from S-280) to be 315 ug/L (Table F.10 of Appendix F) which is below the benzene acute fish criterion of 640 ug/L, but above the chronic fish criterion of 130 ug/L. Therefore, a surface water screening concentration (waste load allocation) for benzene was calculated for S-280 using the PENTOXSD modeling, and is presented in the next section.

A more detailed description of QD model input parameters and results are also presented in Appendix F.

6.3 Surface Water

To evaluate whether potential exists for dissolved phase concentrations of benzene in groundwater to impact the Schuylkill River, a surface water screening concentration (waste load allocation) for benzene was calculated for S-280 using the PENTOXSD modeling (Appendix F).

Aquifer parameters were entered into the groundwater flow equation to calculate the volumetric aquifer discharge to the Schuylkill River (Table F.10). The hydraulic conductivity, hydraulic gradient and cross sectional area was taken directly from the S-280 Quick Domenico simulation (Table F.5).

The PENTOXSD derived a groundwater to surface water screening standard (waste load allocation) for benzene of 1,415 ug/L. The predicted concentration for benzene at the Schuylkill River is 315 ug/L (concentration at S-280 is 41,000 ug/L), which is below the calculated surface water screening concentration, and therefore benzene in groundwater at S-280 does not pose a significant risk to surface water quality in the Schuylkill River.

6.4 LNAPL

Wells S-19, S-59, S-60, S-113, S-285 and RW-2 in AOI 3 contained measurable (>0.01 ft) LNAPL. Monitoring well S-282, which was installed along the western boundary of AOI 4, indicated a different product type (middle distillate), than the product typed at S-59 and S-60 (gas middle distillate). Product identified in S-282 appears to be associated with a separate plume stemming from AOI 4. Based on the LNAPL type, absence of LNAPL in the surrounding monitoring wells, groundwater flow/gradients, and the LNAPL modeling performed as part of the CCR, LNAPL in these wells is stable and immobile. Therefore, no additional LNAPL modeling was completed as part of this SCR/RIR.

6.5 Vapor Intrusion to Indoor Air

There are two potential indoor air receptors in AOI 3. The potential indoor air receptors are identified as occupied building structures which include the Central Warehouse Building and a guard shack located along River Road (Figure 10). This building is occupied by Sunoco and is regulated by OSHA.

To evaluate the vapor intrusion into indoor air pathway for the two occupied buildings, the soil and groundwater data collected during the site characterization activities were screened against the non-residential EPA/PADEP default OSHA residential permissible exposure limits (PELs) volatilization into indoor air screening values, published in the PADEP's final guidance on vapor intrusion into buildings from groundwater and soil under the Act 2 Statewide Health Standard (July 2003). The OSHA PEL soil screening values were selected as appropriate because the site and its industrial operations are regulated by OSHA.

With the exception of two soil samples (BH 10-01 and BH-10-02) and one groundwater sample (S-280), results of the screening evaluation indicated that no soil or groundwater analytical results in AOI 3 exceeded the non-residential EPA/PADEP default screening values or the OSHA PEL screening values. The nearest occupied building to the sample locations with exceedances are over a 100 feet away. In addition, there are no known preferential pathways connecting these locations to the occupied building.

LNAPL is present in five monitoring wells S-19, S-59, S-60, S-113, and S-285, and in one recovery well RW-2 in AOI 3. LNAPL was also observed in S-282, which was a new well installed along the western boundary of AOI 4. However, the nearest occupied building to the nearest LNAPL occurrence location (S-113) is over 800 feet away, and there are no known preferential pathways connecting this location to the occupied building.

7.0 SITE CONCEPTUAL MODEL

A preliminary site conceptual model (SCM) for the Refinery, including AOI 3, was presented in the CCR. Data collected from the recent site characterization activities performed in AOI 3 were used to refine the SCM for this area. The revised SCM for AOI 3 is described below:

7.1 Description and Site Use

AOI 3 is comprised of the #5 Tank Farm, Guard Basin, Four Pond Area, three PDAs, former Chevron Ballfields, contractor parking lot, operating bundle cleaning area, South Flare, contractor office trailer yard, Central Warehouse, and guard shack located along River Road. The current, historic uses/investigations and approximate limits of impervious surfaces are depicted on Figure A-1 provided in Appendix A.

Controls (i.e. permits for excavation, Occupation Safety and Health Administration (OSHA) restrictions, etc.) apply to AOI 3. AOI 3 is restricted by fencing and by security measures. Prior to any work being completed within AOI 3, appropriate work permits, safety and security measures, etc. must be approved by Refinery personnel. These controls limit exposure to site COCs as listed in Table 1.

7.2 Geology and Hydrogeology

The following summarizes relevant information concerning geology and hydrogeology in AOI 3:

- The depth to bedrock beneath AOI 3 is estimated to be 85 to 95 ft bgs;
- The Lower Sand overlies bedrock throughout AOI 3;
- In the central portion of AOI 3, the Middle/Lower Clay inter-fingers with the Lower/Middle Sand. Shallow/intermediate groundwater elevations in this area are generally lower in elevation;
- The Trenton Gravel is differentiated from the fill/alluvium throughout AOI 3 and ranges in thickness from 10 to 50 feet;
- The fill/alluvium materials are present throughout AOI 3 ranging in thickness from 5 to 20 feet;
- Groundwater flow in the fill/alluvium/Trenton Gravel in the northern portion of AOI 3 is to the south-southeast and in the central and northern portions to the east northeast;
- Beneath the clay, a partially-confined or confined aquifer exists in the Lower Sand;
- Groundwater flow in the Lower Sand is generally towards the east southeast; and
- Shallow (fill/alluvium) wells located in the southeast portion of AOI 3 near the Guard Basin show evidence of a perched water table.

7.3 Compounds of Concern

The following summarizes relevant information concerning COCs in AOI 3:

- COCs which were detected in shallow soil at concentrations above their respective non-residential soil MSCs, included: benzene (1 location) and lead (2 locations);
- 1,2-dichloroethane, 1,2,4-TMB, 1,3,5-TMB, cumene, ethylbenzene, ethylene dibromide, MTBE, toluene, xylenes, anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluorene,

naphthalene, phenanthrene and pyrene were not detected in AOI 3 shallow soil samples at concentrations above their respective non-residential soil MSCs;

- COCs detected in groundwater in the fill/alluvium/Trenton Gravel aquifer at concentrations above their respective non-residential groundwater MSCs include: 1,2,4-TMB, 1,3,5-TMB, benzene, toluene, and MTBE; and
- For wells screened in the Lower Sand aquifer beneath the clay, benzene and MTBE were detected at concentrations above their respective non-residential PADEP groundwater MSCs.

The exposure assessment completed for AOI 3 COCs is discussed in Section 8.0.

7.4 LNAPL Distribution and LNAPL Mobility

The following summarizes relevant information concerning LNAPL distribution in AOI 3:

- Measurable LNAPL was detected in existing monitoring wells S-19, S-113, S-59, S-60, and in recovery well RW-2. LNAPL was also detected in two new monitoring wells: S-285 and S-282. LNAPL identified in S-282 appeared to be associated with a separate plume stemming from AOI 4; and
- Based on LNAPL modeling performed for the CCR, the LNAPL type, groundwater flow/gradients, the absence of LNAPL in the surrounding monitoring wells, and the occurrence of LNAPL in these wells over time, it appears the LNAPL in these wells is stable and immobile.

7.5 Fate and Transport of COCs

Fate and transport modeling was completed for wells that exhibited concentrations of Results of the July 2010 groundwater sampling indicated that five organic compounds 1, 2, 4-TMB, 1, 3, 5-TMB, benzene, MTBE, and toluene were detected above their respective groundwater MSCs in seven shallow/intermediate monitoring wells (BF-106, S-16, S-20, S-23, S-280, S-281, and S-288). Groundwater sample results also indicated that two organic compounds (benzene and MTBE) were detected above their respective groundwater MSCs in two deep monitoring wells (BF-108 and S-22).

The potential for off-site migration of dissolved phase COCs in groundwater was evaluated by fate and transport modeling using the Quick Domenico (QD) model. The fate and transport modeling was completed to evaluate potential migration pathways and potential impacts to off-site receptors. The QD Version 2 spreadsheet model and site-specific data was used to perform the fate and transport calculations.

Input and result summary spreadsheets for each monitoring well modeled are included in Appendix F (Tables F.1 through F.9). A comparison between the model-predicted downgradient transport distance and the distance to the nearest property boundary is also included in these tables.

The modeling results indicate that two monitoring wells (S-281 and S-288) contain concentrations of VOCs (1,2,4-TMB and 1,3,5-TMB in S-281 and benzene in S-288) that have the potential to reach the AOI-3 eastern boundary and migrate into AOI 4. Based on the QD simulations, groundwater concentrations in exceedance of the MSC will not reach the Refinery boundary, located along the eastern boundary of AOI 4. Due to the fact that these wells are located over 1,000 feet from the Schuylkill River, and the direction of groundwater flow is away from the Schuylkill River, it is unlikely that groundwater from these two wells will reach the Schuylkill River.

The modeling results for benzene in S-280 were predicted not to attenuate to a concentration below its groundwater MSC by the time it reaches the AOI 3 western boundary (Schuylkill River). The QD model predicts the benzene concentration adjacent to the Schuylkill River (285 feet away from S-280) to be 315 ug/L (Table F.10 in Appendix F) which is below the benzene acute fish criterion of 640 ug/L, but above the chronic fish criterion of 130 ug/L. To evaluate the potential for dissolved phase concentrations of benzene in groundwater to impact the Schuylkill River, a surface water screening concentration (waste load allocation) for benzene was calculated for S-280 using the PENTOXSD modeling (Appendix F). Aquifer parameters were entered into the groundwater flow equation to calculate the volumetric aquifer discharge to the Schuylkill River (Table F.10 in Appendix F). The hydraulic conductivity, hydraulic gradient, and cross sectional area was taken directly from the S-280 Quick Domenico simulation (Table F.5).

The PENTOX derived groundwater to surface water screening standard (waste load allocation) for benzene is 1,415 ug/L. The QD model predicts the benzene concentration adjacent to the Schuylkill River (285 feet away from S-280) to be 315 ug/L (Table F.10) which is below the benzene acute fish criterion of 640 ug/L, but above the chronic fish criterion of 130 ug/L. Therefore, a surface water screening concentration (waste load allocation) for benzene was calculated for S-280 using the PENTOXSD modeling, and is presented in the next section.

7.6 Potential Migration Pathways and Site Receptors

The following summarizes the relevant information concerning the potential pathways and site receptors for AOI 3.

- Operating areas of AOI 3 are located within a fenced, secured area to prevent unauthorized access. Direct contact to site soils (soils greater than two feet beneath the ground surface) is governed by Sunoco's on-site procedures and personal protective equipment (PPE);
- No human health receptors to groundwater exist for the Refinery based on on-site safety procedures and PPE requirements;
- Based on the vapor intrusion evaluation completed (Section 6.5 of this report), there are no complete exposure pathways from groundwater and soil into indoor air at the onsite receptors. Based on the occurrence of LNAPL in select wells in AOI 3 and their distance from the two occupied buildings being more than a 100 feet, further evaluation of the potential vapor intrusion into indoor air pathway for this building is not required; and
- Based on fate and transport modeling, benzene measured in groundwater at well S-280 has the potential to migrate to Schuylkill River at levels above the groundwater MSC. To evaluate the potential for dissolved phase concentrations of benzene in groundwater to impact Schuylkill River, the results of the fate and transport modeling were compared to the surface water quality standards (PA Chapter 16). For benzene the PA GWQ continuous (chronic) and maximum (acute) fish and aquatic life criteria are 130 ug/L and 650 ug/L respectively; and a surface water screening concentration (waste load allocation) for benzene was calculated for S-280 using the PENTOXSD modeling. The PENTOXSD derived

groundwater to surface water screening standard (waste load allocation) for benzene is 1,415 ug/L. The predicted concentration for benzene at the Schuylkill River is 315 ug/L, which is below the calculated surface water screening concentration, and therefore benzene in groundwater at S-280 does not pose a significant risk to surface water quality in the Schuylkill River.

8.0 HUMAN HEALTH EXPOSURE ASSESSMENT/RISK ASSESSMENT

Based on the current and future intended non-residential site use, an exposure assessment was conducted for all compounds which exceeded the non-residential statewide health standards in AOI 3. Potential human health exposures for the Refinery are for an industrial worker scenario. The media evaluated included groundwater, surface soil (less than two feet below grade), and subsurface soil (greater than two feet below grade). As described in Section 6.5, further evaluation of the vapor intrusion pathway is not required based on the lack of complete exposure pathways.

The potential direct contact pathway for soil (greater than two feet), groundwater and LNAPL under the industrial scenario is eliminated through Sunoco's established excavation procedures, PPE requirements and soil handling procedures described in Appendix K of the CCR. However, because direct contact to surface soils could occur outside of excavation activities, shallow soil samples were collected in non-paved areas of AOI 3 to assess this potential exposure pathway.

The following table serves as a summary of potential exposure pathways that can be reasonably expected under the current and intended future non-residential use for AOI 3. The table lists potentially contaminated media, potential receptors for these media, and a summary of whether any potentially complete exposure pathways exist at AOI 3 from the media to these receptors.

Exposure Pathway Evaluation Summary

Contaminated Media	Residents	Workers	Day Care	Construction	Trespassers	Recreation	Food
Groundwater	NA	No ⁽¹⁾	NA	No ⁽²⁾	No	NA	NA
Air (indoor)	NA	No ⁽³⁾	NA	No ⁽³⁾	No	NA	NA
Soil <2 feet bgs.	NA	Yes	NA	Yes	No	NA	NA
Soil >2 feet bgs.	NA	No ⁽⁴⁾	NA	No ⁽⁴⁾	No	NA	NA
Surface Water	NA	No ⁽⁵⁾	NA	No ⁽⁵⁾	NA	NA	NA
Sediment	NA	No ⁽⁵⁾	NA	No ⁽⁵⁾	NA	NA	NA
LNAPL	NA	No ⁽¹⁾	NA	No ⁽²⁾	NA	NA	NA

Notes:

- (1) No complete groundwater or LNAPL pathways exist for workers that are not addressed through on-site procedures and PPE.
 - (2) No complete groundwater or LNAPL pathway exists for construction workers due to PPE requirements and Standard Operating Procedures.
 - (3) No complete pathway to indoor air exists based on the evaluation described in Section 6.5.
 - (4) No complete pathway exists for site soil > 2 feet deep due to PPE requirements and Standard Operating Procedures.
 - (5) No complete pathway exists for surface water and/or sediment due to PPE requirements and Standard Operating Procedures.
- Na - Not applicable
 No - No potential complete exposure pathway
 Yes - Potential complete exposure pathway

A more detailed evaluation of each of these potential exposure pathways is presented in the following sections by media.

8.1 Surface Water/Sediment

The nearest surface water body to AOI 3 is the Schuylkill River which borders the north-western AOI 3 boundary. The Schuylkill River defines the north-western border of AOI 3. The Guard Basin and Four Pond area are permitted stormwater retention features located along in the southern portion of AOI 3 and, based on their function as permitted stormwater features, are not considered ecological receptors.

Based on groundwater flow as depicted in Figures 6 and 7, and the results of the fate and transport modeling for wells with groundwater MSC exceedances, only one COC (benzene) from one well S-280 has the potential to reach Schuylkill River at concentrations exceeding benzene's PA Chapter 93 surface water criteria.

To further evaluate this potential pathway, a waste load allocation for benzene of 1,415 ug/L was calculated using the PENTOXSD model. The predicted concentration for

benzene at the Schuylkill River is 315 ug/L (derived from QD model). This predicted value is below the calculated waste load allocation, and therefore the benzene concentration in groundwater at S-280 does not pose a significant risk to surface water quality in the Schuylkill River.

8.2 Surface Soils (0-2 Feet Below Grade)

8.2.1 Soil-to-Groundwater

The soil-to-groundwater pathway is being addressed through the groundwater pathway discussed in Section 8.3.

8.2.2 Direct Contact Exposure

Two shallow soil samples collected and analyzed as part of the AOI 3 characterization exhibited concentrations of benzene and lead above their respective non-residential direct contact soil MSCs. In accordance with Section IV of the PADEP's Technical Guidance Manual, site-specific standards for lead and benzene were calculated using PADEP default intake parameters for an onsite worker and a risk level of 10^{-4} . For calculating a site-specific standard for on-site workers exposed to lead, Sunoco used the Society of Environmental Geochemistry and Health (SEGH) model used by PADEP to develop the non-residential soil MSCs.

The calculated risk-based site-specific standards presented in Appendix G are as follows:

Compound	Calculated Site-Specific Standard (mg/kg)
Benzene	2,160
Lead	3,140

Concentrations of benzene in the surface soil samples collected in AOI 3 are below the calculated site-specific standards and, therefore, risk to an on-site worker due to direct contact exposure is considered to be within the acceptable Act 2 range. Concentrations of lead detected in the surface soil samples

collected in AOI 3 are below the site-specific standard, with the exception of one soil sample location BH-10-2_1-2, which demonstrated a lead detection of 5,540 mg/kg. With the exception to BH-10-2_1-2 location, risk to an onsite worker due to lead exposure is considered minimal.

In addition to calculating the site-specific standards for benzene and lead, the cumulative risk of exposure was also calculated. Lead exposure is dependent on the blood/lead concentration and not risk based; therefore, lead could not be incorporated into the cumulative risk calculation. The cumulative hazard index is the combined index for exposure to non-carcinogenic compounds, and it cannot exceed 1. For AOI 3 none of the non-carcinogenic compounds exceeded the statewide health standard and, therefore, a cumulative hazard index was not calculated. The total cumulative risk is the combined risk of exposure to the concentrations of carcinogenic compounds, which for AOI 3, is benzene. In accordance with the TGM, the total cumulative risk cannot exceed 10^{-4} . As presented in Table G-3, the total cumulative risk of exposure to the carcinogenic compounds in AOI 3 is $5.30E^{-08}$, and therefore, no remedies are required for AOI 3 to address direct contact to benzene in soil.

8.3 Groundwater

Results of the July 2010 groundwater sampling indicates that five organic compounds, including 1,2,4-TMB, 1,3,5-TMB, benzene, toluene, and MTBE, were detected above their respective groundwater MSCs in seven shallow/intermediate wells. Groundwater sample results also indicated that two organic compounds (benzene and MTBE) were detected above their respective groundwater MSCs in deep monitoring wells (BF-108 and S-22). Previous investigations (URS, 2002) verified that no monitoring wells located within 1.5 miles of the Refinery are used for drinking water or agricultural use. Also, there are no complete direct contact exposure pathways for groundwater within AOI 3 because of on-site Refinery safety procedures and required PPE.

Based on the completed fate and transport modeling, the only dissolved phase COC in groundwater that appears to have the potential to extend off-site is along western boundary of AOI 3. The COC (benzene) from well (S-280) has the potential to reach Schuylkill River at concentrations exceeding benzene's PA Chapter 93 surface water

criteria. Based on further evaluation of this condition as described in Section 8.1, there appears to be no unacceptable risk to ecological receptors in the Schuylkill River.

8.4 LNAPL

There are no complete direct contact exposure pathways for LNAPL within AOI 3 because of on-site procedures and required PPE.

8.5 Vapor

The results of the screening evaluation using the PADEP's guidance indicated that no soil or groundwater analytical results in AOI 3 exceeded the non-residential EPA/PADEP OSHA PEL screening values, with the exception of two soil sample locations (BH 10-01 and BH-10-02) and one groundwater sample location (S-280). However, the nearest occupied building to these sample locations is over 100 feet away. In addition, there are no known preferential migration pathways connecting these locations to the occupied building in AOI 3.

There is no LNAPL within 100 feet of an occupied building or any preferential migration pathway that is within 100 feet of an occupied building, therefore LNAPL does not pose a significant risk.

9.0 ECOLOGICAL ASSESSMENT

The majority of AOI 3 is covered with pavement, soil and gravel. Paved areas are primarily located in northern portion of AOI 3 as shown in Appendix A. The soil and gravel-covered portions of AOI 3 are not likely to serve as a breeding area, migratory stopover, or primary habitat for wildlife. In 2002, a survey of endangered, threatened and special concern wildlife was conducted by reviewing maps provided at the Pennsylvania Department of Conservation and Natural Resources. No endangered, threatened or special concern wildlife were identified using these maps or during historical investigations. Based on this information, there are no terrestrial ecological receptors of concern for AOI 3 and no related assessment was necessary.

The nearest surface water body to AOI 3 is the Schuylkill River which borders the north-western property boundary. Based on the results of completed fate and transport modeling and diffuse flow modeling using PENTOXSD, the concentration of benzene in groundwater at S-280 does not pose an unacceptable risk to ecological receptors in the Schuylkill River.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the completed site characterization activities described in this report, the following conclusions and recommendations have been developed for AOI 3:

SOIL

With regard to the potential direct-contact pathway to shallow soil:

- Concentrations of benzene detected in surface soil sample BH-10-01_1-2 (750 ug/kg) was below the calculated site-specific standard of 2,160 mg/kg. Sunoco will delineate the benzene concentrations in soil around this location to ensure that soil in this area is below the calculated site-specific standard.
- The concentration of lead detected in surface soil sample S-285_1-2 (536 mg/kg) was below the calculated site-specific standard of 3,140 mg/kg. Sunoco will delineate the lead concentrations in soil around this location to ensure that soil in this area is below the calculated site-specific standard.
- The concentration of lead in soil sample BH-10-02_1-2 (5,540 mg/kg) was above the calculated site-specific standard of 3,140 mg/kg. Sunoco will further delineate the lead concentrations in soil in this area and will select a remedy which will either remediate the lead issue or eliminate the potential exposure pathway to on-site workers. Delineation and remediation activities will be described in a Cleanup Plan.
- No other shallow soil samples exhibited concentrations of COCs above their respective MSCs.

With regard to the potential direct-contact pathway to deeper soil (i.e., greater than 2 ft deep) and the soil-to-groundwater pathway:

- The direct contact pathway to soil greater than 2 feet beneath the ground surface at the refinery is incomplete because of on-site procedures and PPE requirements that protect onsite workers from exposure. The soil-to-groundwater pathway was evaluated using shallow groundwater data as is discussed below.

GROUNDWATER

- For wells that exhibited concentrations of COCs above their respective groundwater MSCs, fate and transport modeling was completed using the QD model. Based on the QD modeling results, groundwater concentrations in exceedance of the MSC, are not predicted to reach the Refinery boundary, with the exception of groundwater in well S-280 which exhibited a benzene concentration of 41,000 ug/L. Based on the QD modeling results for this well, concentrations of benzene above its groundwater MSC could potentially reach the Schuylkill River.
- To further evaluate the likelihood of benzene in S-280 adversely affecting the surface water quality of the Schuylkill River, the PENTOXSD model was used to calculate a wasteload allocation for benzene to calculate a wasteload allocation for benzene. The QD-predicted concentration of benzene at the interface with the river (315 ug/L) is below the PENTOXSD-calculated benzene wasteload allocation of 1,415 ug/L.
- Sunoco will investigate the source of elevated benzene concentrations in groundwater at S-280.

SOIL VAPOR

The results of the vapor intrusion screening evaluation using the PADEP guidance indicated:

- Only two occupied buildings are located in AOI 3; which include the Central Warehouse Building and guard shack located along River Road.
- Two soil samples (BH 10-01 and BH-10-02) and one groundwater sample (S-280) exceeded the EPA/PADEP default vapor screening values. However, the nearest occupied building is located over 100 feet away from these wells. In addition, there are no known preferential pathways connecting these locations to occupied buildings.

- The nearest LNAPL occurrence (S-113) to the nearest occupied building (Central Warehouse Building) is over 800 feet away, and there are no known preferential pathways connecting this location to the occupied building.

Based on the results of this evaluation, no further evaluation of the potential vapor intrusion into indoor air pathway for the occupied buildings are necessary.

LNAPL

- The horizontal extent of the LNAPL plume, relative to the site boundaries, is delineated and the potential for migrating LNAPL to reach a site boundary is minimal.
- The direct contact exposure pathway to LNAPL is incomplete because of on-site procedures and PPE requirements that protect onsite workers from exposure.

RCRA SWMU

- The Guard Basin was listed as SWMU #3 pursuant to EPA's corrective action program in the 1992 RFI. Extensive investigation of the Guard Basin was completed as part of the RFI by ENSR in 1992 (ENSR, 1992). The results of the RFI indicated that there were no unacceptable risks posed by soil or sediments in the Guard Basin, and because the Lower Sand unit beneath the Guard Basin is not used as a source of potable water, the benzene concentrations detected in this unit also posed no unacceptable risk.
- The Guard Basin is currently regulated by the Refinery's NPDES permit #PA0012629 A1 via outfall #002 (when water is returned to the Point Breeze wastewater treatment plant) or outfall #004 (when water is discharged directly to the Schuylkill River). Groundwater results collected as part of the site characterization activities downgradient of the Guard Basin indicate the basin is not adversely affecting groundwater quality in the vicinity. Based on the results of the investigation completed at the Guard Basin by ENSR in 1992, the results of the recent characterization activities described in this report, and active NPDES permit governing this storm water retention basin, Sunoco is requesting EPA issue a comfort letter acknowledging that no further action is required for SWMU 3 and that this area is eligible for delisting as a SWMU.

11.0 REFERENCES

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TABLES

TABLES

Table 1
Constituents of Concern for Groundwater
AOI 3 Site Characterization/Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

METALS	CAS No.
Lead (dissolved)	7439-92-1

VOLATILE ORGANIC COMPOUNDS	CAS No.
1,2-Dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene dibromide	106-93-4
Methyl tertiary butyl ether	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Notes:

1. Constituents are from Pennsylvania Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E (pgs. 29-30) of PADEP Document, *Closure Requirements for Underground Storage Tank Systems*, effective April 1, 1998 and the March 18, 2008 revised PADEP Petroleum Short List.

Table 1 (continued)
Constituents of Concern for Soil
AOI 3 Site Characterization/Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

METALS	CAS No.
Lead (total)	7439-92-1

VOLATILE ORGANIC COMPOUNDS	CAS No.
1,2-Dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene dibromide	106-93-4
Methyl tertiary butyl ether	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo (g,h,i) perylene	191-24-2
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Notes:

1. Constituents are from Pennsylvania Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E (pgs. 29-30) of PADEP Document, *Closure Requirements for Underground Storage Tank Systems*, effective April 1, 1998 and the March 18, 2008 revised PADEP Petroleum Short List.

**Table 2
AOI 3 Existing Well Summary
As of July 2010
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania**

Well ID	Former Well ID ¹	Northing	Easting	Well Type	Well Classification ²	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Construction Details ³							
									Well Completion Depth (ft. bgs)	Well Diameter (in)	Top of Inner Casing Elevation ⁴ (ft. msl) (NAVD88)	Ground Surface Elevation (ft.) (NAVD88)	Top of Screen Elevation (ft) (NAVD88)	Bottom of Screen Elevation (ft) (NAVD88)	Depth to Screen (ft. bgs)	Screen Length (ft.)
BF-101	--	219686.760	2683565.160	Monitoring Well	Shallow	Y	Y	10/15/86	13	4	6.87	4.51	1.51	-8.49	3	10
AS-8	--	--	--	Monitoring Well	--	Y	Y	2/12/82	35	--	--	--	--	--	25	10
BF-100	--	219458.120	2683127.700	Monitoring Well	Shallow/Intermediate	Y	Y	10/17/86	19.5	4	12.36	9.46	-0.04	-10.04	9.5	10
BF-102 ⁵	--	219222.016	2683560.409	Monitoring Well	Shallow/Intermediate	Y	Y	10/10/86	13	4	--	8.40	5.40	-4.60	3	10
BF-103R	BF-103	219959.250	2682490.900	Monitoring Well	Shallow/Intermediate	Y	Y	10/8/86	14	4	14.57	12.43	8.43	-1.57	4	10
BF-104	--	219137.500	2682830.270	Monitoring Well	Shallow/Intermediate	--	--	--	--	--	11.74	9.20	--	--	--	--
BF-105	--	219442.740	2682998.390	Monitoring Well	Shallow/Intermediate	--	--	--	--	--	11.91	9.59	--	--	--	--
BF-106	--	219737.350	2683176.470	Monitoring Well	Shallow/Intermediate	--	--	--	--	--	13.62	10.70	--	--	--	--
BF-107	--	219941.350	2683307.290	Monitoring Well	Shallow/Intermediate	--	--	--	--	--	12.36	10.10	--	--	--	--
BF-108	--	219700.730	2683185.260	Monitoring Well	Deep	--	--	--	--	--	10.98	9.46	--	--	--	--
BF-88 ⁵	--	220205.407	2683615.740	Monitoring Well	Shallow	Y	Y	2/26/86	14.5	4	--	12.93	8.43	-1.57	4.5	10
BF-89	--	--	--	Monitoring Well	Shallow	Y	Y	2/19/86	13.5	4	--	11.81	8.31	-1.69	3.5	10
BF-90	--	218954.220	2683035.400	Monitoring Well	Shallow	Y	Y	2/19/86	13	4	7.21	7.04	4.04	-5.96	3	10
BF-90D	--	218957.830	2683042.380	Monitoring Well	Intermediate/Deep	--	--	--	--	--	9.32	7.17	--	--	--	--
BF-99	--	219974.000	2683158.770	Monitoring Well	Shallow/Intermediate	Y	Y	10/21/86	19.5	4	10.96	10.32	0.82	-9.18	9.5	10
RW-2	--	220837.390	2683712.400	Recovery Well - Active	Intermediate	Y	Y	3/26/97	36	14	11.29	10.17	0.17	-19.83	10	20
S-1	SM-51	218592.740	2683071.780	Monitoring Well	Shallow	Y	N	8/1/85	30	--	6.71	4.84	--	--	--	--
S-10	MW-23, B-23	218444.340	2683682.170	Monitoring Well	Shallow/Intermediate	Y	Y	3/17/82	25.5	--	6.07	6.33	-9.17	-19.17	15.5	10
S-11	MW-3, B-3	218661.600	2683575.630	Monitoring Well	Shallow	Y	Y	2/11/92	12	4	6.39	6.55	2.55	-6.45	4	9
S-112 ⁵	--	220610.770	2683035.520	Monitoring Well	Shallow/Intermediate	Y	Y	7/24/96	37	2	--	15.94	14.19	-20.81	1.75	35
S-113	--	220679.850	2683404.640	Monitoring Well	Shallow/Intermediate	Y	Y	7/25/96	25	2	12.68	12.85	8.35	-11.65	4.5	20
S-114 ⁴	--	220130.920	2683138.520	Monitoring Well	Shallow/Intermediate	Y	Y	7/25/96	20.25	2	--	9.87	5.87	-10.13	4	16
S-12	MW-24, B-24	218879.190	2683521.470	Monitoring Well	Shallow/Intermediate	Y	Y	3/18/82	26	2	6.36	6.44	-8.56	-17.81	15	9.25
S-13	MW-9, B-9	218891.500	2683521.790	Monitoring Well	Deep	Y	Y	2/26/92	85	2	6.48	6.27	-58.73	-68.73	65	10
S-14	MW-8, B-8	218903.880	2683519.430	Monitoring Well	Shallow	Y	Y	2/18/92	12	4	6.10	5.97	-1.03	-6.03	7	5
S-15	SM-52	218914.110	2683519.960	Monitoring Well	Shallow	Y	N	7/31/85	10	--	5.98	5.91	--	--	--	--
S-16	MW-25, B-25	218964.820	2683816.550	Monitoring Well	Shallow/Intermediate	Y	Y	3/20/92	37	2	23.68	21.83	-4.17	-14.17	26	10
S-17	SM-30	219271.090	2683785.000	Monitoring Well	Shallow/Intermediate	Y	N	12/14/84	25	--	19.93	17.36	--	--	--	--
S-18	MW-7, B-7	218958.810	2683823.140	Monitoring Well	Shallow	Y	Y	2/18/92	18	4	23.49	21.79	16.79	6.79	5	10
S-19	MW-6, B-6	218820.640	2684046.510	Monitoring Well	Shallow	Y	Y	2/17/92	16	4	18.60	17.30	13.30	3.30	4	10
S-2	SM-49	218077.400	2683360.830	Monitoring Well	Shallow	Y	N	7/31/85	10	--	7.21	--	--	--	--	--
S-20	MW-26, B-26	218851.250	2684071.820	Monitoring Well	Shallow/Intermediate	Y	Y	3/23/92	36	2	20.26	17.90	-7.20	-17.20	25	10
S-21	SM-43	218915.190	2683996.230	Monitoring Well	Shallow	Y	N	3/18/85	13	--	22.48	20.01	--	--	--	--
S-22	MW-11, B-11	218842.350	2684080.790	Monitoring Well	Deep	Y	Y	3/19/92	85	2	18.66	17.41	-52.59	-62.59	70	10
S-23	MW-5, B-5	218578.540	2684062.130	Monitoring Well	Intermediate	Y	Y	2/13/92	26	4	20.28	18.45	2.45	-7.55	16	10
S-24	--	218724.840	2684110.460	Monitoring Well	Shallow	Y	N	3/18/85	16	--	19.73	17.51	16.51	1.51	1	15
S-25	SM-44	218447.310	2684274.680	Monitoring Well	Shallow/Intermediate	Y	N	3/18/85	18	--	14.83	12.17	--	--	--	--
S-3	SM-47	217784.310	2683570.390	Monitoring Well	Shallow	Y	N	7/31/85	15	--	10.80	7.67	--	--	--	--
S-4	--	--	--	Abandoned	Shallow	Y	N	7/31/85	10	--	--	--	--	--	--	--
S-5	MW-4, B-4	218241.620	2683837.490	Monitoring Well	Shallow	Y	Y	2/15/92	9	4	6.24	6.42	2.42	-2.58	4	5
S-59	60	220840.300	2683738.780	Monitoring Well	Shallow/Intermediate	Y	Y	12/13/86	31	--	12.87	10.71	0.71	-17.29	10	18
S-6	MW-10, B-10	--	--	Monitoring Well	Deep	Y	Y	3/2/92	72	4	--	8.37	-53.63	-63.63	62	10
S-60	SM-18	221051.050	2683756.400	Monitoring Well	Shallow/Intermediate	Y	N	12/17/84	17	--	12.28	12.25	--	--	--	--
S-66	SM-17	221326.920	2682718.110	Monitoring Well	Intermediate	Y	N	12/14/84	30	--	27.58	25.66	--	--	--	--
S-68	SM-23	--	--	Monitoring Well	Shallow	Y	N	12/20/84	15	--	--	10.49	--	--	--	--
S-69 ⁶	SM-26	219959.590	2682402.000	Monitoring Well	Shallow/Intermediate	Y	N	12/20/84	16	--	14.12	11.88	--	--	--	--
S-69D	--	219970.516	2682398.764	Monitoring Well	Deep	N	N	3/2/94	64	2	13.64	11.70	-42.30	-52.30	54	10
S-7	MW-22	--	--	Abandoned	Shallow	Y	Y	3/16/92	26	2	--	7.27	--	--	--	10
S-8	MW-2, B-2	218427.640	2683688.160	Monitoring Well	Deep	Y	Y	2/19/92	91	2	6.05	6.33	-53.67	-63.17	60	9.5
S-9	MW-1, B-1	218437.410	2683683.180	Monitoring Well	Shallow	Y	Y	2/11/92	12	4	6.18	6.56	1.56	-8.44	5	10
S-280	--	220965.975	2682599.133	Monitoring Well	Intermediate	Y	Y	4/28/10	25	2	26.52	23.73	13.73	-1.27	10	15
S-280D	--	220955.220	2682595.586	Monitoring Well	Deep	Y	Y	5/17/10	61	4	25.88	23.42	-27.58	-37.58	51	10
S-281	--	221048.826	2683656.198	Monitoring Well	Intermediate	Y	Y	5/13/10	25	2	14.36	14.87	4.87	-10.13	10	15
S-282	--	220826.502	2683959.500	Monitoring Well	Shallow/Intermediate	Y	Y	4/27/10	20	2	20.79	18.49	13.49	-1.51	5	15
S-283	--	220303.500	2682503.325	Monitoring Well	Intermediate	Y	Y	5/14/10	24	2	11.14	11.48	2.48	-12.52	9	15
S-284	--	220364.392	2683135.374	Monitoring Well	Shallow/Intermediate	Y	Y	5/13/10	20	2	9.51	9.81	4.81	-10.19	5	15
S-284D	--	220356.118	2683136.483	Monitoring Well	Deep	Y	Y	5/25/10	78	4	12.12	9.71	-53.29	-68.29	63	15
S-285	--	219690.184	2683686.687	Monitoring Well	Shallow/Intermediate	Y	Y	4/27/10	20	2	15.21	12.70	7.70	-7.30	5	15
S-288	--	219275.824	2683002.691	Monitoring Well	Shallow/Intermediate	Y	Y	6/17/10	15	2	19.09	17.25	12.25	2.25	5	10
S-290	--	219190.984	2683622.988	Monitoring Well	Shallow/Intermediate	Y	Y	4/27/10	20	2	11.69	9.27	4.27	-10.73	5	15
S-291	--	218060.579	2683971.681	Monitoring Well	Shallow	Y	Y	4/26/10	20	2	11.99	9.46	4.46	-10.54	5	15

NOTES:

-- Data could not be located or determined based on available reports

Abandoned/destroyed wells.

AOI - Area of Interest

ft. - feet

bgs - below ground surface

in. - inches

msl - elevation relative to mean sea level

g/cc - grams per cubic centimeter

NA - Data not available

1. Former well IDs were derived from handwritten notes on the logs themselves or the referenced report.

2. Well classification based on the formation the well screens. Wells screened within the Middle Clay or the Farrington Sand are classified as deep wells.

Well classification for wells screened above the Lower/Middle Clay are based on the following: Wells screened in Fill/Alluvium = Shallow; Wells screened in Trenton Gravel = Intermediate; Wells screened in Fill/Alluvium & Trenton Gravel = Shallow/Intermediate

3. Well construction details were taken directly from well boring logs provided by Handex, Stantec, Aquaterra or collected from available historic reports.

4. Wells were surveyed by Langan in December 2009 and July 2010.

5. Wells could not be located.

6. Well is damaged.

Table 3
Summary of AOI 3 Groundwater and LNAPL Elevations
July 2010
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Well Classification ¹	Specific Gravity (g/cc) Used for Corrected GW Elevation		Depth to Product (ft btic)	Depth to GW (ft btic) ⁴	LNAPL Thickness (ft)	LNAPL Elevation (ft amsl)	GW Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft. msl)	Static/Pumping
					S.G. ²	Source ³								
AOI 3														
BF-100	219458.120	2683127.7	Monitoring Well	Shallow			NP	12.00			0.36	0.36	12.36	Static
BF-103R	219959.250	2682490.900	Monitoring Well	Shallow			NP	14.25			0.32	0.32	14.57	Static
BF-104	219137.500	2682830.270	Monitoring Well	Shallow			NP	6.54			5.20	5.20	11.74	Static
BF-105	219442.740	2682998.390	Monitoring Well	Shallow			NP	11.66			0.25	0.25	11.91	Static
BF-106	219737.350	2683176.470	Monitoring Well	Shallow			NP	13.32			0.30	0.30	13.62	Static
BF-107	219941.350	2683307.290	Monitoring Well	Intermediate			NP	11.96			0.40	0.40	12.36	Static
BF-108	219700.730	2683185.260	Monitoring Well	Deep			NP	10.85			0.13	0.13	10.98	Static
BF-88	220205.407	2683615.740	Monitoring Well	Shallow			NP	8.81			-0.38	-0.38	8.43	Static
BF-90	218954.220	2683035.400	Monitoring Well	Shallow			NP	2.06			5.15	5.15	7.21	Static
BF-99	219974.000	2683158.770	Monitoring Well	Shallow			NP	10.50			0.46	0.46	10.96	Static
RW-2	220837.390	2683712.400	Recovery Well - Active	Intermediate	0.8039	S-59	11.16	11.32	0.16	0.130	-0.03	0.10	11.29	Static
S-1	218592.740	2683071.780	Monitoring Well	Shallow			NP	2.41			4.30	4.30	6.71	Static
S-10	218444.340	2683682.170	Monitoring Well	Shallow			NP	4.35			1.72	1.72	6.07	Static
S-11	218661.600	2683575.630	Monitoring Well	Shallow			NP	3.17			3.22	3.22	6.39	Static
S-113	220679.850	2683404.640	Monitoring Well	Shallow	0.8039	S-59	11.86	12.45	0.59	0.820	0.23	0.70	12.68	Static
S-13	218891.500	2683521.790	Monitoring Well	Deep			NP	7.24			-0.76	-0.76	6.48	Static
S-14	218903.880	2683519.430	Monitoring Well	Shallow			NP	3.03			3.07	3.07	6.10	Static
S-16	218964.820	2683816.550	Monitoring Well	Shallow			NP	22.45			1.23	1.23	23.68	Static
S-17	219271.090	2683785.000	Monitoring Well	Shallow			NP	18.73			1.20	1.20	19.93	Static
S-18	218958.810	2683823.140	Monitoring Well	Shallow			NP	4.24			19.25	19.25	23.49	Static
S-19	218820.640	2684046.510	Monitoring Well	Shallow	0.9281	S-21	6.03	6.05	0.02	12.570	12.55	12.57	18.60	Static
S-20	218851.250	2684071.820	Monitoring Well	Shallow			NP	19.07			1.19	1.19	20.26	Static
S-21	218915.190	2683996.230	Monitoring Well	Shallow			NP	10.43			12.05	12.05	22.48	Static
S-22	218842.350	2684080.790	Monitoring Well	Deep			NP	19.20			-0.54	-0.54	18.66	Static
S-23	218578.540	2684062.130	Monitoring Well	Intermediate			NP	19.09			1.19	1.19	20.28	Static
S-24	218724.840	2684110.460	Monitoring Well	Shallow			NP	2.57			17.16	17.16	19.73	Static
S-25	218447.310	2684274.680	Monitoring Well	Shallow			NP	13.71			1.12	1.12	14.83	Static
S-3	217784.310	2683570.390	Monitoring Well	Shallow			NP	7.17			3.63	3.63	10.80	Static
S-5	218241.620	2683837.490	Monitoring Well	Shallow				2.98			3.25	3.25	6.24	Static
S-59	220840.300	2683738.780	Monitoring Well	Shallow	0.8039	S-59	8.54	9.22	0.68	4.330	3.65	4.20	12.87	Static
S-60	221051.050	2683756.400	Monitoring Well	Shallow	0.7898	S-60	11.33	12.05	0.72	0.950	0.23	0.80	12.28	Static
S-69D	219970.516	2682398.764	Monitoring Well	Deep			NP	13.87			-0.23	-0.23	13.64	Static
S-8	218427.640	2683688.160	Monitoring Well	Deep			NP	0.00			6.05	6.05	6.05	Static
S-9	218437.410	2683683.180	Monitoring Well	Shallow			NP	2.91			3.27	3.27	6.18	Static
S-280	220965.975	2682599.133	Monitoring Well	Shallow			NP	25.68			0.84	0.84	26.52	Static
S-280D	220955.220	2682595.586	Monitoring Well	Deep			NP	25.91			-0.03	-0.03	25.88	Static
S-281	221048.826	2683656.198	Monitoring Well	Shallow			NP	13.11			1.25	1.25	14.36	Static
S-282	220826.502	2683959.500	Monitoring Well	Shallow	0.8104	S-282	19.81	20.65	0.84	0.978	0.14	0.82	20.79	Static
S-283	220303.500	2682503.325	Monitoring Well	Shallow			NP	10.98			0.16	0.16	11.14	Static
S-284	220364.392	2683135.374	Monitoring Well	Shallow			NP	6.30			3.21	3.21	9.51	Static
S-284D	220356.118	2683136.483	Monitoring Well	Deep			NP	11.64			0.48	0.48	12.12	Static
S-285	219690.184	2683686.687	Monitoring Well	Shallow	0.8921	S-285	13.94	14.53	0.59	1.273	0.68	1.21	15.21	Static
S-288	219275.824	2683002.691	Monitoring Well	Shallow			NP	15.93			3.16	3.16	19.09	Static
S-290	219190.984	2683622.988	Monitoring Well	Shallow			NP	10.19			1.50	1.50	11.69	Static
S-291	218060.579	2683971.681	Monitoring Well	Shallow			NP	7.99			4.00	4.00	11.99	Static

Notes:

- Well type was chosen based on the formation the well screens. Wells screened within the Middle Clay or the Farrington Sand are classified as deep wells. Based on their total depth, wells screened above the Middle Clay are classified as either a shallow and/or intermediate well.
- Specific Gravity (S.G.) values were determined from LNAPL samples collected by Aquaterra/Stantec as part of CCR and/or SCR/RIR.
- For wells with no direct LNAPL density measurements, the density value in the nearest well with LNAPL data was used.
- Depth to water and depth to LNAPL provided by Stantec July 2010. All wells gauged on 7/13 & 7/14/10 unless otherwise noted.

g/cc = grams per cubic centimeter

<.01 = Sheen or film of product on groundwater.

LNAPL = Light Non-Aqueous Phase Liquid

ft amsl = Feet Above Mean Sea Level

GW = Groundwater

NA = Not Applicable

NM = Not Measured

NP = No Product

ft btic = Feet Below Top of Inner Casing

Table 4
Summary of Soil Analytical Results (April - June 2010)
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Used Aquifer Soil MSCs (TDS<2,500)	Location	AOI-3			AOI-3			AOI-3			AOI-3			AOI-3					
			Sample ID	BH-10-01_1-2			BH-10-02_1-2			BH-10-03_1-2			BH-10-04_1-2			S-280_1-2			S-282_1-2		
			Sample Date	4/26/2010			4/26/2010			4/27/2010			5/13/2010			4/28/2010			4/27/2010		
			Sample Matrix	Soil			Soil			Soil			Soil			Soil			Soil		
			Start Depth	1			1			1			1			1			1		
			End Depth	2			2			2			2			2			2		
			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
Volatile Organic Compounds																					
1,2,4-TRIMETHYLBENZENE	95-63-6	20000	ug/kg	220	J	46	750		59	ND	U	5	ND	U	5	ND	U	5	ND	U	4
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	5	ug/kg	ND	U	46	ND	U	59	ND	U	5	ND	U	5	ND	U	5	ND	U	4
1,2-DICHLOROETHANE	107-06-2	500	ug/kg	ND	U	46	120	J	59	ND	U	5	ND	U	5	ND	U	5	ND	U	4
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	6200	ug/kg	53	J	46	330		59	ND	U	5	ND	U	5	ND	U	5	ND	U	4
BENZENE	71-43-2	500	ug/kg	750		23	300		29	ND	U	5	ND	U	5	ND	U	5	ND	U	4
DIMETHYL BENZENE/ XYLENES, TOTAL	1330-20-7	1000000	ug/kg	310		46	1800		59	ND	U	5	ND	U	5	ND	U	5	ND	U	4
ETHYLBENZENE	100-41-4	70000	ug/kg	160	J	46	310		59	ND	U	5	ND	U	5	ND	U	5	ND	U	4
ISOPROPYLBENZENE (CUMENE)	98-82-8	1600000	ug/kg	3000		46	ND	U	59	ND	U	5	ND	U	5	ND	U	5	ND	U	4
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	2000	ug/kg	ND	U	23	ND	U	29	ND	U	5	ND	U	5	ND	U	5	ND	U	4
TOLUENE	108-88-3	100000	ug/kg	77	J	46	910		59	ND	U	5	ND	U	5	ND	U	5	ND	U	4
Semi-volatile Organic Compounds																					
ANTHRACENE	120-12-7	350000	ug/kg	290		37	100	J	39	ND	U	200	ND	U	200	ND	U	190	ND	U	200
BENZO(A)ANTHRACENE	56-55-3	320000	ug/kg	290		37	290		39	ND	U	200	ND	U	200	300		190	ND	U	200
BENZO(A)PYRENE	50-32-8	46000	ug/kg	190		37	290		39	ND	U	200	ND	U	200	220		190	ND	U	200
BENZO(B)FLUORANTHENE	205-99-2	170000	ug/kg	230		37	400		39	ND	U	200	ND	U	200	290		190	ND	U	200
BENZO(G,H,I)PERYLENE	191-24-2	180000	ug/kg	200		37	380		39	ND	U	200	ND	U	200	ND	U	190	ND	U	200
CHRYSENE	218-01-9	230000	ug/kg	330		37	430		39	200		200	ND	U	200	300		190	ND	U	200
FLUORENE	86-73-7	3800000	ug/kg	670		37	50	J	39	ND	U	200	ND	U	200	ND	U	190	ND	U	200
NAPHTHALENE	91-20-3	25000	ug/kg	230		37	1500		39	ND	U	200	ND	U	200	ND	U	190	ND	U	200
PHENANTHRENE	85-01-8	10000000	ug/kg	1700		37	430		39	200		200	ND	U	200	240		190	ND	U	200
PYRENE	129-00-0	2200000	ug/kg	650		37	530		39	330		200	ND	U	200	480		190	ND	U	200
Metals																					
LEAD	7439-92-1	450	mg/kg	130		0.081	5540		1.7	73.9		0.237	32.2		0.235	266		1.13	87.3		0.229
General Chemistry																					
MOISTURE, PERCENT	MOIST	NC	%	9		0.5	15		0.5	15.5		0.5	17.2		0.5	13.9		0.5	15.9		0.5

Notes:

PADEP - Pennsylvania Department of Environmental Protection
mg/kg - milligram per kilogram
ug/kg - microgram per kilogram
MSC - PADEP's Medium Specific Concentration for Soil
RL - Reporting Limit
ND - Not Detected
NC - No Criteria
TDS - Total Dissolved Solids

Qualifiers:

Q - Lab Qualifier
U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument
J - Estimated value – The result is ≥ the MDL and < the LOQ.

Exceedance Summary:

10	Result exceeds the PADEP Non-Residential Soil MSC
10	RL exceeds the PADEP Non-Residential Soil MSC

Table 4
Summary of Soil Analytical Results (April - June 2010)
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Used Aquifer Soil MSCs (TDS<2,500)	Location	AOI-3			AOI-3			AOI-3			AOI-3			AOI-3					
			Sample ID	S-284_1-2			S-285_1-2			S-286_1-2			S-288_1-2			S-290_1-2			S-291_1-2		
			Sample Date	5/13/2010			4/27/2010			4/27/2010			6/17/2010			4/27/2010			4/26/2010		
			Sample Matrix	Soil			Soil			Soil			Soil			Soil			Soil		
			Start Depth	1			1			1			1			1			1		
			End Depth	2			2			2			2			2			2		
			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
Volatile Organic Compounds																					
1,2,4-TRIMETHYLBENZENE	95-63-6	20000	ug/kg	ND	U	4	ND	U	5	ND	U	55	ND	U	5	79	J	63	ND	U	4
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	5	ug/kg	ND	U	4	ND	U	5	ND	U	55	ND	U	5	ND	U	63	ND	U	4
1,2-DICHLOROETHANE	107-06-2	500	ug/kg	ND	U	4	ND	U	5	ND	U	55	ND	U	5	ND	U	63	ND	U	4
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	6200	ug/kg	ND	U	4	ND	U	5	ND	U	55	ND	U	5	ND	U	63	ND	U	4
BENZENE	71-43-2	500	ug/kg	ND	U	4	17		5	31	J	28	8		5	34	J	31	ND	U	4
DIMETHYL BENZENE/ XYLENES, TOTAL	1330-20-7	1000000	ug/kg	ND	U	4	10		5	ND	U	55	5		5	120	J	63	ND	U	4
ETHYLBENZENE	100-41-4	70000	ug/kg	ND	U	4	ND	U	5	ND	U	55	ND	U	5	ND	U	63	ND	U	4
ISOPROPYLBENZENE (CUMENE)	98-82-8	1600000	ug/kg	ND	U	4	ND	U	5	ND	U	55	ND	U	5	ND	U	63	ND	U	4
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	2000	ug/kg	ND	U	4	ND	U	5	ND	U	28	ND	U	5	ND	U	31	ND	U	4
TOLUENE	108-88-3	100000	ug/kg	ND	U	4	ND	U	5	ND	U	55	9		5	ND	U	63	ND	U	4
Semi-volatile Organic Compounds																					
ANTHRACENE	120-12-7	350000	ug/kg	ND	U	190	ND	U	4000	2100		390	3500		180	ND	U	400	ND	U	180
BENZO(A)ANTHRACENE	56-55-3	320000	ug/kg	ND	U	190	ND	U	4000	2600		390	7600		910	620	J	400	ND	U	180
BENZO(A)PYRENE	50-32-8	46000	ug/kg	ND	U	190	ND	U	4000	1400	J	390	7200		910	ND	U	400	ND	U	180
BENZO(B)FLUORANTHENE	205-99-2	170000	ug/kg	ND	U	190	ND	U	4000	2000		390	8600		910	480	J	400	ND	U	180
BENZO(G,H,I)PERYLENE	191-24-2	180000	ug/kg	ND	U	190	ND	U	4000	1100	J	390	5000		910	ND	U	400	ND	U	180
CHRYSENE	218-01-9	230000	ug/kg	ND	U	190	ND	U	4000	2400		390	7600		910	810	J	400	ND	U	180
FLUORENE	86-73-7	3800000	ug/kg	ND	U	190	ND	U	4000	ND	U	390	1600		180	ND	U	400	ND	U	180
NAPHTHALENE	91-20-3	25000	ug/kg	ND	U	190	ND	U	4000	ND	U	390	2900		180	ND	U	400	ND	U	180
PHENANTHRENE	85-01-8	10000000	ug/kg	ND	U	190	ND	U	4000	3800		390	16000		910	820	J	400	ND	U	180
PYRENE	129-00-0	2200000	ug/kg	ND	U	190	ND	U	4000	5300		390	13000		910	1100	J	400	ND	U	180
Metals																					
LEAD	7439-92-1	450	mg/kg	14.3		0.223	536		2.31	151		0.086	223		1.08	320		0.171	254		0.524
General Chemistry																					
MOISTURE, PERCENT	MOIST	NC	%	11.9		0.5	16.1		0.5	14.1		0.5	8.1		0.5	15.7		0.5	8.3		0.5

Notes:

PADEP - Pennsylvania Department of Environmental Protection
mg/kg - milligram per kilogram
ug/kg - microgram per kilogram
MSC - PADEP's Medium Specific Concentration for Soil
RL - Reporting Limit
ND - Not Detected
NC - No Criteria
TDS - Total Dissolved Solids

Qualifiers:

Q - Lab Qualifier
U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument
J - Estimated value – The result is ≥ the MDL and < the LOQ.

Exceedance Summary:

10	Result exceeds the PADEP Non-Residential Soil MSC
10	RL exceeds the PADEP Non-Residential Soil MSC

Table 5
Summary of Groundwater Analytical Results
Shallow/Intermediate Wells
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Used Aquifer Groundwater MSCs (TDS <2,500)	Location	BF-100			BF-103R			BF-104			BF-105			BF-106			BF-107		
			Sample ID	BF-100_072210			BF-103R_071610			BF-104R_072110			BF-105_072210			BF-106_072210			BF-107_072210		
			Sample Date	7/22/2010			7/16/2010			7/21/2010			7/22/2010			7/22/2010			7/22/2010		
			Sample Matrix	Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Volatile Organic Compounds			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	130		2	ND	U	2
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	25		2	ND	U	2
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
BENZENE	71-43-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	130		1	ND	U	1
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	31		2	52		2
ETHYLBENZENE	100-41-4	700	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	56		1	ND	U	1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.029	ND	U	0.03	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	20	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
TOLUENE	108-88-3	1000	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	2		1	7		1
XYLENES (TOTAL)	1330-20-7	10000	ug/l	ND	U	1	ND	U	1	2		1	ND	U	1	19		1	ND	U	1
Semi-volatile Organic Compounds																					
CHRYSENE	218-01-9	1.9	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5
FLUORENE	86-73-7	1900	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	28		5	78		5
NAPHTHALENE	91-20-3	100	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	37		5	ND	U	5
PHENANTHRENE	85-01-8	1100	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	29		5	70		5
PYRENE	129-00-0	130	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	7		5
Metals																					
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	0.0012		0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001

Notes:

PADEP - Pennsylvania Department of Environmental Protection
ug/l - microgram per liter
mg/l - milligram per liter
MSC - PADEP's Medium Specific Concentration for Groundwater
RL - Reporting Limit
ND - Not Detected
TDS - Total Dissolved Solids

Qualifiers:

Q - Lab Qualifier
U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument
J - Estimated value – The result is ≥ the MDL and < the LOQ.

Exceedance Summary:

10 - Result exceeds the PADEP Non-Residential Groundwater MSC
10 - RL exceeds the PADEP Non-Residential Groundwater MSC

**Table 5
Summary of Groundwater Analytical Results
Shallow/Intermediate Wells
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania**

Chemical Name	CAS No	PADEP Non-Residential Used Aquifer Groundwater MSCs (TDS <2,500)	Location	BF-88			BF-90			BF-99			S-1			S-10			S-11		
			Sample ID	BF-88_072210			BF-90_072110			BF-99_072210			S-1_072110			S-10_072110			S-11_072110		
			Sample Date	7/22/2010			7/21/2010			7/22/2010			7/21/2010			7/21/2010			7/21/2010		
			Sample Matrix	Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Volatile Organic Compounds			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	ND	U	2	3		2	20		2	ND	U	2	ND	U	2	ND	U	2
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	ND	U	2	ND	U	2	12		2	ND	U	2	ND	U	2	ND	U	2
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
BENZENE	71-43-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	ND	U	2	ND	U	2	7		2	ND	U	2	8		2	ND	U	2
ETHYLBENZENE	100-41-4	700	ug/l	ND	U	1	1		1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.029	ND	U	0.029	ND	U	0.03	ND	U	0.029	ND	U	0.029	ND	U	0.029
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	20	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	5		1	2		1
TOLUENE	108-88-3	1000	ug/l	ND	U	1	1		1	9		1	ND	U	1	ND	U	1	ND	U	1
XYLENES (TOTAL)	1330-20-7	10000	ug/l	ND	U	1	15		1	2		1	ND	U	1	ND	U	1	ND	U	1
Semi-volatile Organic Compounds																					
CHRYSENE	218-01-9	1.9	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5
FLUORENE	86-73-7	1900	ug/l	ND	U	5	ND	U	5	8		5	ND	U	5	ND	U	5	ND	U	5
NAPHTHALENE	91-20-3	100	ug/l	ND	U	5	ND	U	5	10		5	ND	U	5	ND	U	5	ND	U	5
PHENANTHRENE	85-01-8	1100	ug/l	ND	U	5	ND	U	5	7		5	ND	U	5	ND	U	5	ND	U	5
PYRENE	129-00-0	130	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5
Metals																					
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	0.0012		0.001

Notes:

PADEP - Pennsylvania Department of Environmental Protection
ug/l - microgram per liter
mg/l - milligram per liter
MSC - PADEP's Medium Specific Concentration for Groundwater
RL - Reporting Limit
ND - Not Detected
TDS - Total Dissolved Solids

Qualifiers:

Q - Lab Qualifier
U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument
J - Estimated value – The result is ≥ the MDL and < the LOQ.

Exceedance Summary:

10 - Result exceeds the PADEP Non-Residential Groundwater MSC
10 - RL exceeds the PADEP Non-Residential Groundwater MSC

Table 5
Summary of Groundwater Analytical Results
Shallow/Intermediate Wells
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Used Aquifer Groundwater MSCs (TDS <2,500)	Location	S-12			S-14			S-16			S-17			S-18			S-2		
			Sample ID	S-12_072110			S-14_072110			S-16_071610			S-17_071610			S-18_071610			S-2_072110		
			Sample Date	7/21/2010			7/21/2010			7/16/2010			7/16/2010			7/16/2010			7/21/2010		
			Sample Matrix	Groundwater																	
Volatile Organic Compounds																					
Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	ND	U	2	ND	U	2	400		10	ND	U	2	ND	U	2	ND	U	2
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	ND	U	2	ND	U	2	140		10	ND	U	2	ND	U	2	ND	U	2
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	1	ND	U	1		U	5	ND	U	1	ND	U	1	ND	U	1
BENZENE	71-43-2	5	ug/l	ND	U	1	ND	U	1	220		5	ND	U	1	ND	U	1	ND	U	1
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	4		2	ND	U	2	88		10	4		2	7		2	ND	U	2
ETHYLBENZENE	100-41-4	700	ug/l	ND	U	1	ND	U	1	110		5	ND	U	1	ND	U	1	ND	U	1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.03	ND	U	0.03	ND	U	0.029
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	20	ug/l	4		1	ND	U	1	40		5	5		1	ND	U	1	ND	U	1
TOLUENE	108-88-3	1000	ug/l	ND	U	1	ND	U	1	44		5	ND	U	1	ND	U	1	ND	U	1
XYLENES (TOTAL)	1330-20-7	10000	ug/l	ND	U	1	ND	U	1	380		5	2		1	ND	U	1	ND	U	1
Semi-volatile Organic Compounds																					
CHRYSENE	218-01-9	1.9	ug/l	ND	U	5	ND	U	5	ND	U	24	ND	U	5	ND	U	5	ND	U	5
FLUORENE	86-73-7	1900	ug/l	ND	U	5	ND	U	5	ND	U	24	ND	U	5	ND	U	5	ND	U	5
NAPHTHALENE	91-20-3	100	ug/l	ND	U	5	ND	U	5	ND	U	24	ND	U	5	ND	U	5	ND	U	5
PHENANTHRENE	85-01-8	1100	ug/l	ND	U	5	ND	U	5	29		24	ND	U	5	ND	U	5	ND	U	5
PYRENE	129-00-0	130	ug/l	ND	U	5	ND	U	5	ND	U	24	ND	U	5	ND	U	5	ND	U	5
Metals																					
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001															

Notes:

PADEP - Pennsylvania Department of Environmental Protection
ug/l - microgram per liter
mg/l - milligram per liter
MSC - PADEP's Medium Specific Concentration for Groundwater
RL - Reporting Limit
ND - Not Detected
TDS - Total Dissolved Solids

Qualifiers:

Q - Lab Qualifier
U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument
J - Estimated value – The result is ≥ the MDL and < the LOQ.

Exceedance Summary:

10 - Result exceeds the PADEP Non-Residential Groundwater MSC
10 - RL exceeds the PADEP Non-Residential Groundwater MSC

**Table 5
Summary of Groundwater Analytical Results
Shallow/Intermediate Wells
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania**

Chemical Name	CAS No	PADEP Non-Residential Used Aquifer Groundwater MSCs (TDS <2,500)	Location	S-20			S-23			S-280			S-281			S-283			S-284		
			Sample ID	S-20_071610			S-23_070710			S-280_070710			S-281_071510			S-283_071610			S-284_071510		
			Sample Date	7/16/2010			7/7/2010			7/7/2010			7/15/2010			7/16/2010			7/15/2010		
			Sample Matrix	Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Volatile Organic Compounds			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	ND	U	2	51		2	ND	U	100	1200		20	ND	U	2	ND	U	2
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	ND	U	2	15		2	ND	U	100	520		20	ND	U	2	ND	U	2
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	1	ND	U	1	ND	U	50	ND	U	10	ND	U	1	ND	U	1
BENZENE	71-43-2	5	ug/l	ND	U	1	ND	U	1	41000		500	ND	U	10	ND	U	1	ND	U	1
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	15		2	2		2	ND	U	100	220		20	ND	U	2	ND	U	2
ETHYLBENZENE	100-41-4	700	ug/l	ND	U	1	24		1	ND	U	50	80		10	ND	U	1	ND	U	1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.03	ND	U	0.029	ND	U	0.028	ND	U	0.029	ND	U	0.029	ND	U	0.029
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	20	ug/l	97		1	ND	U	1	ND	U	50	ND	U	10	ND	U	1	ND	U	1
TOLUENE	108-88-3	1000	ug/l	ND	U	1	6		1	6900		50	ND	U	10	ND	U	1	ND	U	1
XYLENES (TOTAL)	1330-20-7	10000	ug/l	3		1	57		1	ND	U	50	130		10	ND	U	1	ND	U	1
Semi-volatile Organic Compounds																					
CHRYSENE	218-01-9	1.9	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5
FLUORENE	86-73-7	1900	ug/l	ND	U	5	ND	U	5	7		5	5		5	ND	U	5	ND	U	5
NAPHTHALENE	91-20-3	100	ug/l	ND	U	5	ND	U	5	6		5	38		5	ND	U	5	ND	U	5
PHENANTHRENE	85-01-8	1100	ug/l	ND	U	5	ND	U	5	12		5	ND	U	5	ND	U	5	ND	U	5
PYRENE	129-00-0	130	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5
Metals																					
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001

Notes:

PADEP - Pennsylvania Department of Environmental Protection
ug/l - microgram per liter
mg/l - milligram per liter
MSC - PADEP's Medium Specific Concentration for Groundwater
RL - Reporting Limit
ND - Not Detected
TDS - Total Dissolved Solids

Qualifiers:

Q - Lab Qualifier
U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument
J - Estimated value – The result is ≥ the MDL and < the LOQ.

Exceedance Summary:

10 - Result exceeds the PADEP Non-Residential Groundwater MSC
10 - RL exceeds the PADEP Non-Residential Groundwater MSC

Table 5
Summary of Groundwater Analytical Results
Shallow/Intermediate Wells
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Used Aquifer Groundwater MSCs (TDS <2,500)	Location	S-288			S-290			S-291			S-3			S-5			S-9		
			Sample ID	S-288_072210			S-290_070710			S-291_070710			S-3_072110			S-5_072110			S-9_072110		
			Sample Date	7/22/2010			7/7/2010			7/7/2010			7/21/2010			7/21/2010			7/21/2010		
			Sample Matrix	Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Volatile Organic Compounds			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	47		2	33		2	ND	U	20	ND	U	2	ND	U	2	ND	U	2
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	16		2	9		2	ND	U	20	ND	U	2	ND	U	2	ND	U	2
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	1	ND	U	1	ND	U	10	ND	U	1	ND	U	1	ND	U	1
BENZENE	71-43-2	5	ug/l	280		10	3		1	ND	U	10	ND	U	1	ND	U	1	ND	U	1
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	27		2	ND	U	2	ND	U	20	ND	U	2	13		2	ND	U	2
ETHYLBENZENE	100-41-4	700	ug/l	20		1	12		1	ND	U	10	ND	U	1	ND	U	1	ND	U	1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.03	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	20	ug/l	ND	U	1	ND	U	1	ND	U	10	ND	U	1	1		1	8		1
TOLUENE	108-88-3	1000	ug/l	7		1	38		1	ND	U	10	ND	U	1	ND	U	1	ND	U	1
XYLENES (TOTAL)	1330-20-7	10000	ug/l	69		1	99		1	ND	U	10	ND	U	1	2		1	ND	U	1
Semi-volatile Organic Compounds																					
CHRYSENE	218-01-9	1.9	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5
FLUORENE	86-73-7	1900	ug/l	8		5	ND	U	5	ND	U	5	ND	U	5	5		5	ND	U	5
NAPHTHALENE	91-20-3	100	ug/l	14		5	ND	U	5	25		5	ND	U	5	ND	U	5	ND	U	5
PHENANTHRENE	85-01-8	1100	ug/l	9		5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5
PYRENE	129-00-0	130	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5
Metals																					
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001

Notes:

PADEP - Pennsylvania Department of Environmental Protection
ug/l - microgram per liter
mg/l - milligram per liter
MSC - PADEP's Medium Specific Concentration for Groundwater
RL - Reporting Limit
ND - Not Detected
TDS - Total Dissolved Solids

Qualifiers:

Q - Lab Qualifier
U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument
J - Estimated value – The result is ≥ the MDL and < the LOQ.

Exceedance Summary:

10 - Result exceeds the PADEP Non-Residential Groundwater MSC
10 - RL exceeds the PADEP Non-Residential Groundwater MSC

Table 6
Summary of Groundwater Analytical Results
Deep (Lower Sand) Wells
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Used Aquifer Groundwater MSCs (TDS <2,500)	Location	BF-108			BF-90D			S-22			S-280D			S-284D			S-69D			S-8			
			Sample ID	BF-108_072210			BF-90D_072110			S-22_071610			S-280D_072310			S-284D_072310			S-69D_072210			S-8_072110			
			Sample Date	7/22/2010			7/21/2010			7/16/2010			7/23/2010			7/23/2010			7/22/2010			7/21/2010			
			Sample Matrix	Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater						
Volatile Organic Compounds				Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	ND	U	2	ND	U	2	2		2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	
BENZENE	71-43-2	5	ug/l	ND	U	1	ND	U	1	6		1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	
ETHYLBENZENE	100-41-4	700	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	
TERT-BUTYL METHYL ETHER	1634-04-4	20	ug/l	120		1	ND	U	1	48		1	2		1	ND	U	1	2		1	1		1	
TOLUENE	108-88-3	1000	ug/l	ND	U	1	ND	U	1	7		1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	
XYLENES (TOTAL)	1330-20-7	10000	ug/l	ND	U	1	1		1	17		1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	
Semi-volatile Organic Compounds				Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
CHRYSENE	218-01-9	1.9	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	47	
FLUORENE	86-73-7	1900	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	47	
NAPHTHALENE	91-20-3	100	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	47	
PHENANTHRENE	85-01-8	1100	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	47	
PYRENE	129-00-0	130	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	47	
Metals				Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	0.0011		0.001	

Notes:

PADEP - Pennsylvania Department of Environmental Protection
ug/l - microgram per liter
mg/l - milligram per liter
MSC - PADEP's Medium Specific Concentration for Groundwater
RL - Reporting Limit
ND - Not Detected
TDS - Total Dissolved Solids
Q - Lab Qualifier

Qualifiers:

U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument
J - Estimated value – The result is ≥ the MDL and < the LOQ.

Exceedance Summary:

10	- Result exceeds the PADEP Non-Residential Groundwater MSC
10	- RL exceeds the PADEP Non-Residential Groundwater MSC

Table 7
Summary of Soil Analytical Results Screened for Protection of Indoor Air
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	USEPA-PA Defaults Nonresidential Volatilization to Indoor Air Screen	USEPA-PA Defaults Nonresidential PELs Volatilization to Indoor Air Screen	Location	AOI-3	AOI-3	AOI-3	AOI-3	AOI-3	AOI-3	AOI-3	AOI-3	AOI-3	AOI-3	AOI-3	AOI-3	
				Sample ID	BH-10-01_1-2	BH-10-02_1-2	BH-10-03_1-2	BH-10-04_1-2	S-280_1-2	S-282_1-2	S-284_1-2	S-285_1-2	S-286_1-2	S-288_1-2	S-290_1-2	S-291_1-2	
				Sample Date	4/26/2010	4/26/2010	4/27/2010	5/13/2010	4/28/2010	4/27/2010	5/13/2010	4/27/2010	4/27/2010	6/17/2010	4/27/2010	4/26/2010	
				Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	
				Start Depth	1	1	1	1	1	1	1	1	1	1	1	1	
				End Depth	2	2	2	2	2	2	2	2	2	2	2	2	
				Units	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	
Volatile Organic Compounds																	
1,2,4-TRIMETHYLBENZENE	95-63-6	29,000	310,000	ug/kg	220	750	ND	ND	ND	ND	ND	ND	ND	ND	79	ND	
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	290	1,000,000	ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,2-DICHLOROETHANE	107-06-2	73	8,300	ug/kg	ND	120	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	6,400	87,000	ug/kg	53	330	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
BENZENE	71-43-2	630	380,000	ug/kg	750	300	ND	ND	ND	ND	ND	17	31	8	34	ND	
DIMETHYL BENZENE/ XYLENES, TOTAL	1330-20-7	77,000	170,000	ug/kg	310	1800	ND	ND	ND	ND	ND	10	ND	5	120	ND	
ETHYLBENZENE	100-41-4	9,500	110,000	ug/kg	160	310	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
ISOPROPYLBENZENE (CUMENE)	98-82-8	360,000	360,000	ug/kg	3000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TERT-BUTYL METHYL ETHER	1634-04-4	86,000	6,400,000	ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TOLUENE	108-88-3	110,000	240,000	ug/kg	77	910	ND	ND	ND	ND	ND	ND	ND	9	ND	ND	
Semi-volatile Organic Compounds																	
ANTHRACENE	120-12-7	NOC	NOC	ug/kg	290	100	ND	ND	ND	ND	ND	ND	ND	2100	3500	ND	ND
BENZO(A)ANTHRACENE	56-55-3	NCA	NCA	ug/kg	290	290	ND	ND	300	ND	ND	ND	2600	7600	620	ND	
BENZO(A)PYRENE	50-32-8	NCA	NCA	ug/kg	190	290	ND	ND	220	ND	ND	ND	1400	7200	ND	ND	
BENZO(B)FLUORANTHENE	205-99-2	NCA	NCA	ug/kg	230	400	ND	ND	290	ND	ND	ND	2000	8600	480	ND	
BENZO(G,H,I)PERYLENE	191-24-2	NCA	NCA	ug/kg	200	380	ND	ND	ND	ND	ND	ND	1100	5000	ND	ND	
CHRYSENE	218-01-9	NCA	NCA	ug/kg	330	430	200	ND	300	ND	ND	ND	2400	7600	810	ND	
FLUORENE	86-73-7	NOC	NOC	ug/kg	670	50	ND	ND	ND	ND	ND	ND	ND	1600	ND	ND	
NAPHTHALENE	91-20-3	NOC	NOC	ug/kg	230	1500	ND	ND	ND	ND	ND	ND	ND	2900	ND	ND	
PHENANTHRENE	85-01-8	NOC	NOC	ug/kg	1700	430	200	ND	240	ND	ND	ND	3800	16000	820	ND	
PYRENE	129-00-0	NCA	NCA	ug/kg	650	530	330	ND	480	ND	ND	ND	5300	13000	1100	ND	
Metals																	
LEAD	7439-92-1	NCA	NCA	mg/kg	130	5540	73.9	32.2	266	87.3	14.3	536	151	223	320	254	
General Chemistry																	
MOISTURE, PERCENT	MOIST	NCA	NCA	%	9	15	15.5	17.2	13.9	15.9	11.9	16.1	14.1	8.1	15.7	8.3	

Notes:
USEPA - United States Environmental Protection Agency
ug/kg - microgram per kilogram
mg/kg - milligram per kilogram
ND - Not Detected
NOC - Not of Concern
NCA - No Criterion Available
PEL - Permissible Exposure Limit
All laboratory qualifiers and reporting limits are provided in Table 4.

Exceedance Summary:
10 Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air
10 Result exceeds the USEPA-PA Default Nonresidential PELs Volatilization to Indoor Air

Table 8
Summary of Groundwater Analytical Results Screened for Protection of Indoor Air
Shallow/Intermediate Wells
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	USEPA-PA Defaults Nonresidential Volatilization to Indoor Air Screening Criteria	USEPA-PA Defaults Nonresidential PELs Volatilization to Indoor Air Screening Criteria	Location	BF-100	BF-103R	BF-104	BF-105	BF-106	BF-107
				Sample ID	BF-100_072210	BF-103R_071610	BF-104R_072110	BF-105_072210	BF-106_072210	BF-107_072210
				Sample Date	7/22/2010	7/16/2010	7/21/2010	7/22/2010	7/22/2010	7/22/2010
				Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	ND	ND	ND	ND	130	ND
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	ND	ND	ND	ND	25	ND
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	ND	ND	ND	ND	130	ND
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	ND	ND	ND	ND	31	52
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	ND	ND	ND	ND	56	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	ND	ND	ND	ND	ND	ND
TOLUENE	108-88-3	NOC	NOC	ug/l	ND	ND	ND	ND	2	7
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	ND	ND	2	ND	19	ND
Semi-volatile Organic Compounds										
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND
FLUORENE	86-73-7	NOC	NOC	ug/l	ND	ND	ND	ND	28	78
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	ND	ND	ND	ND	37	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	ND	ND	ND	ND	29	70
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	ND	ND	ND	7
Metals										
LEAD	7439-92-1	NCA	NCA	mg/l	ND	0.0012	ND	ND	ND	ND

Notes:

USEPA - United States Environmental Protection Agency
ug/l - microgram per liter
mg/l - milligram per liter
ND - Not Detected
NOC - Not of Concern
NCA - No Criterion Available
PEL - Permissible Exposure Limit
All laboratory qualifiers and reporting limits are provided in Table 5.

Exceedance Summary:

10	- Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air
10	- Result exceeds USEPA-PA Default Nonresidential PELs Volatilization to Indoor Air

Table 8
Summary of Groundwater Analytical Results Screened for Protection of Indoor Air
Shallow/Intermediate Wells
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	USEPA-PA Defaults Nonresidential Volatilization to Indoor Air Screening Criteria	USEPA-PA Defaults Nonresidential PELs Volatilization to Indoor Air Screening Criteria	Location	BF-88	BF-90	BF-99	S-1	S-10	S-11
				Sample ID	BF-88_072210	BF-90_072110	BF-99_072210	S-1_072110	S-10_072110	S-11_072110
				Sample Date	7/22/2010	7/21/2010	7/22/2010	7/21/2010	7/21/2010	7/21/2010
				Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	ND	3	20	ND	ND	ND
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	ND	ND	12	ND	ND	ND
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	ND	ND	ND	ND	ND	ND
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	ND	ND	7	ND	8	ND
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	ND	1	ND	ND	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	ND	ND	ND	ND	5	2
TOLUENE	108-88-3	NOC	NOC	ug/l	ND	1	9	ND	ND	ND
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	ND	15	2	ND	ND	ND
Semi-volatile Organic Compounds										
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND
FLUORENE	86-73-7	NOC	NOC	ug/l	ND	ND	8	ND	ND	ND
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	ND	ND	10	ND	ND	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	ND	ND	7	ND	ND	ND
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND
Metals										
LEAD	7439-92-1	NCA	NCA	mg/l	ND	ND	ND	ND	ND	0.0012

Notes:

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mg/l - milligram per liter
ND - Not Detected
NOC - Not of Concern
NCA - No Criterion Available
PEL - Permissible Exposure Limit
All laboratory qualifiers and reporting limits are provided in Table 5.

Exceedance Summary:

- 10** - Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air
- 10** - Result exceeds USEPA-PA Default Nonresidential PELs Volatilization to Indoor Air

Table 8
Summary of Groundwater Analytical Results Screened for Protection of Indoor Air
Shallow/Intermediate Wells
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	USEPA-PA Defaults Nonresidential Volatilization to Indoor Air Screening Criteria	USEPA-PA Defaults Nonresidential PELs Volatilization to Indoor Air Screening Criteria	Location	S-12	S-14	S-16	S-17	S-18	S-2
				Sample ID	S-12_072110	S-14_072110	S-16_071610	S-17_071610	S-18_071610	S-2_072110
				Sample Date	7/21/2010	7/21/2010	7/16/2010	7/16/2010	7/16/2010	7/21/2010
				Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	ND	ND	400	ND	ND	ND
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	ND	ND	140	ND	ND	ND
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	ND	ND	220	ND	ND	ND
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	4	ND	88	4	7	ND
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	ND	ND	110	ND	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	4	ND	40	5	ND	ND
TOLUENE	108-88-3	NOC	NOC	ug/l	ND	ND	44	ND	ND	ND
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	ND	ND	380	2	ND	ND
Semi-volatile Organic Compounds										
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND
FLUORENE	86-73-7	NOC	NOC	ug/l	ND	ND	ND	ND	ND	ND
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	ND	ND	ND	ND	ND	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	ND	ND	29	ND	ND	ND
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND
Metals										
LEAD	7439-92-1	NCA	NCA	mg/l	ND	ND	ND	ND	ND	ND

Notes:

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ND - Not Detected
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PEL - Permissible Exposure Limit
All laboratory qualifiers and reporting limits are provided in Table 5.

Exceedance Summary:

- 10** - Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air
- 10** - Result exceeds USEPA-PA Default Nonresidential PELs Volatilization to Indoor Air

Table 8
Summary of Groundwater Analytical Results Screened for Protection of Indoor Air
Shallow/Intermediate Wells
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	USEPA-PA Defaults Nonresidential Volatilization to Indoor Air Screening Criteria	USEPA-PA Defaults Nonresidential PELs Volatilization to Indoor Air Screening Criteria	Location	S-20	S-23	S-280	S-281	S-283	S-284
				Sample ID	S-20_071610	S-23_070710	S-280_070710	S-281_071510	S-283_071610	S-284_071510
				Sample Date	7/16/2010	7/7/2010	7/7/2010	7/15/2010	7/16/2010	7/15/2010
				Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	ND	51	ND	1200	ND	ND
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	ND	15	ND	520	ND	ND
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	ND	ND	41000	ND	ND	ND
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	15	2	ND	220	ND	ND
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	ND	24	ND	80	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	97	ND	ND	ND	ND	ND
TOLUENE	108-88-3	NOC	NOC	ug/l	ND	6	6900	ND	ND	ND
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	3	57	ND	130	ND	ND
Semi-volatile Organic Compounds										
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND
FLUORENE	86-73-7	NOC	NOC	ug/l	ND	ND	7	5	ND	ND
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	ND	ND	6	38	ND	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	ND	ND	12	ND	ND	ND
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND
Metals										
LEAD	7439-92-1	NCA	NCA	mg/l	ND	ND	ND	ND	ND	ND

Notes:

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PEL - Permissible Exposure Limit
All laboratory qualifiers and reporting limits are provided in Table 5.

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- 10** - Result exceeds USEPA-PA Default Nonresidential PELs Volatilization to Indoor Air

Table 8
Summary of Groundwater Analytical Results Screened for Protection of Indoor Air
Shallow/Intermediate Wells
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	CAS No	USEPA-PA Defaults Nonresidential Volatilization to Indoor Air Screening Criteria	USEPA-PA Defaults Nonresidential PELs Volatilization to Indoor Air Screening Criteria	Location	S-288	S-290	S-291	S-3	S-5	S-9
				Sample ID	S-288_072210	S-290_070710	S-291_070710	S-3_072110	S-5_072110	S-9_072110
				Sample Date	7/22/2010	7/7/2010	7/7/2010	7/21/2010	7/21/2010	7/21/2010
				Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	47	33	ND	ND	ND	ND
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	16	9	ND	ND	ND	ND
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	280	3	ND	ND	ND	ND
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	27	ND	ND	ND	13	ND
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	20	12	ND	ND	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	ND	ND	ND	ND	1	8
TOLUENE	108-88-3	NOC	NOC	ug/l	7	38	ND	ND	ND	ND
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	69	99	ND	ND	2	ND
Semi-volatile Organic Compounds										
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND
FLUORENE	86-73-7	NOC	NOC	ug/l	8	ND	ND	ND	5	ND
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	14	ND	25	ND	ND	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	9	ND	ND	ND	ND	ND
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND
Metals										
LEAD	7439-92-1	NCA	NCA	mg/l	ND	ND	ND	ND	ND	ND

Notes:

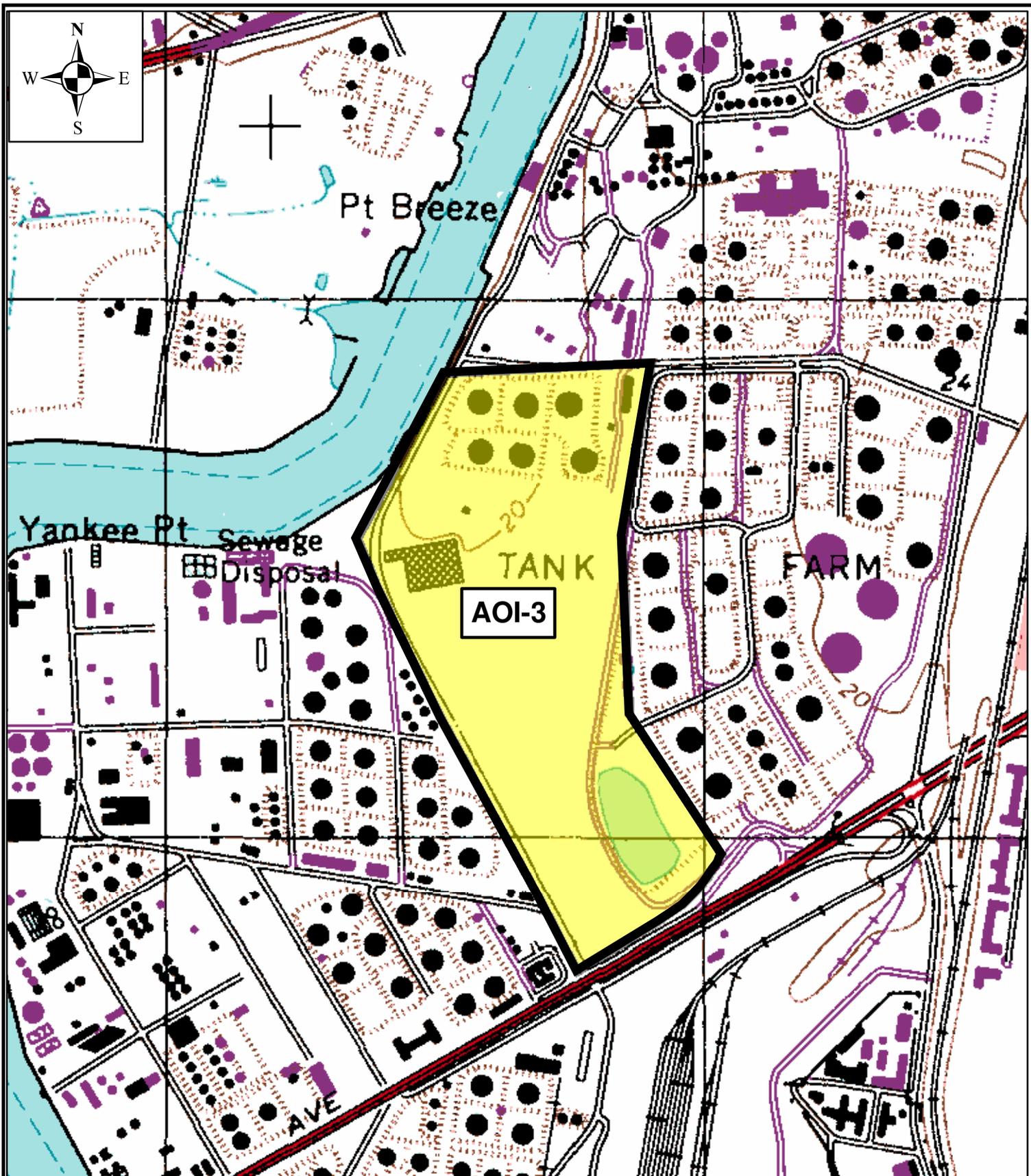
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- 10** - Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air
- 10** - Result exceeds USEPA-PA Default Nonresidential PELs Volatilization to Indoor Air

FIGURES

FIGURES



USGS Topographic Map, Philadelphia, PA. Quadrangle, USGS 1995



Sunoco, Inc. (R&M) Philadelphia Refinery

3144 Passyunk Avenue
Philadelphia, PA. 19145

Figure 1: Site Location Map: AOI-3
AOI-3 Site Characterization Report/
Remedial Investigation Report

Philadelphia Pennsylvania

Job Number

2574601

Scale: 1" = 800'

0 400 800
Feet

Date

July 1, 2010



SCHUYLKILL RIVER

AOI-2

AOI-4

AOI-3

AOI-7

Notes:
1. 2005 aerial photography provided by the Delaware Valley Regional Planning Commission (DVRPC).

Legend

 AOI Boundary



Figure 2: Site Plan
AOI-3 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania



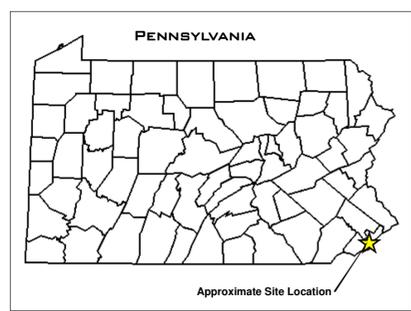
Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 70 140 280
Feet

SCALE: 1" = 140'
DATE: MAY 1, 2010
DWN BY: DM
DID BY: DM
JOB#: 201001



Notes:
 1. 2005 aerial photography provided by the Delaware Valley Regional Planning Commission (DVRPC).



Legend

- Deep Monitoring Well
- Intermediate Monitoring Well
- Shallow Monitoring Well
- ◆ Shallow/Intermediate Monitoring Well
- Shallow/Intermediate Recovery Well
- Intermediate Recovery Well
- ⊕ Piezometer
- ⊕ Other Monitoring Well
- ⊕ Damaged/Abandoned/Unable to Locate
- Cross Section Location (AA - AA')
- Cross Section Location (BB - BB')
- Cross Section Location (X - X')
- Cross Section Location (Z - Z')
- Area of Interest (AOI) Boundary

Figure 4: Cross Section Location Plan
 AOI-3 Site Characterization/
 Remedial Investigation Report
 Sunoco Philadelphia Refinery
 Philadelphia, Pennsylvania



Sunoco, Inc. (R&M)
 Philadelphia Refinery
 3144 Passyunk Avenue
 Philadelphia, PA.
 19145

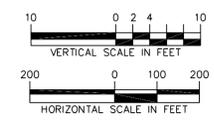
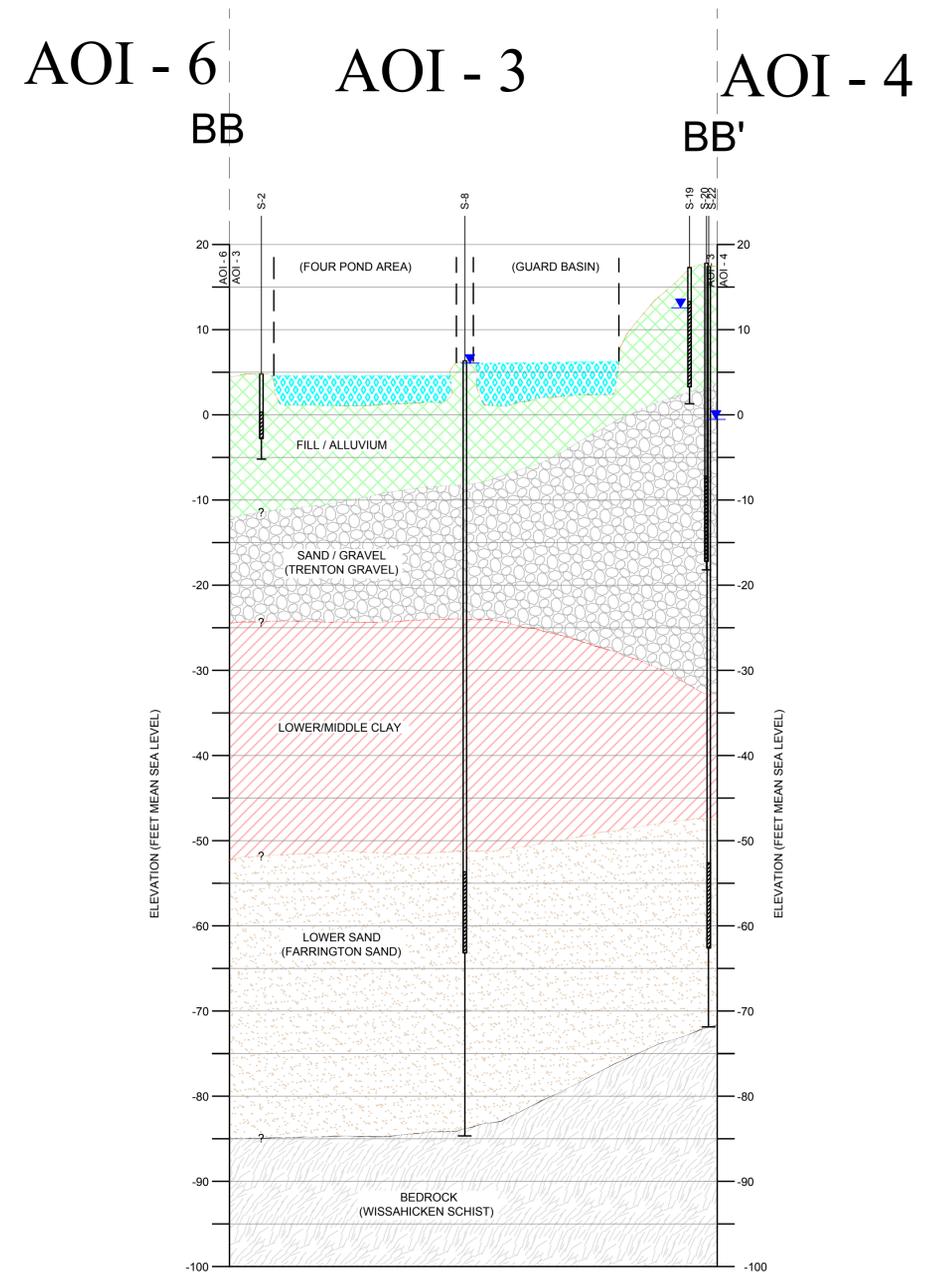
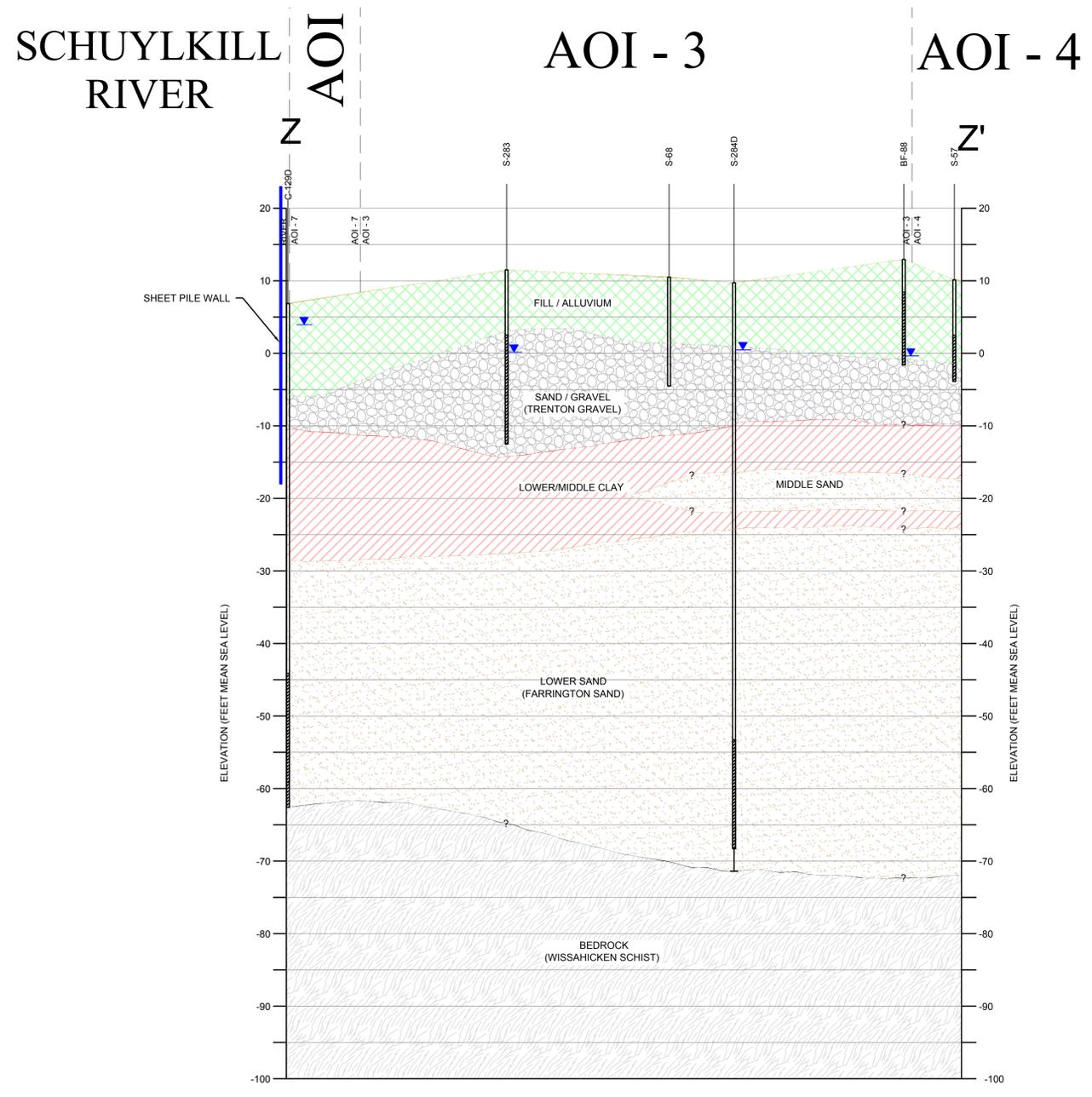


SCALE: 1" = 140'
 DATE: August 20, 2010
 DRN: BY: DMV
 CDD: BY: DMV
 JOB#: 2010001

LEGEND:

	WATER	C-129D	LOCATION ID
	FILL / ALLUVIUM		WELL CASING/BOREHOLE
	TRENTON GRAVEL		WELL SCREEN
	CLAY		BOTTOM OF BOREHOLE
	SAND		INFERRED CONTACTS
	WEATHERED BEDROCK		GROUNDWATER LEVEL
			SHEET PILE WALL

- NOTES:**
- LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
 - WELL SCREEN INTERVAL INFORMATION NOT AVAILABLE FOR S-2 AND S-68
 - DEPTH OF SHEET PILE WAS DETERMINED FROM FIGURE 2-8 GENERALIZED GEOLOGICAL CROSS SECTION A-C DATED NOVEMBER 13, 1992 FROM DAMES AND MOORE, RCRA VERIFICATION INVESTIGATION REPORT, CHEVRON REFINERY, 1992, CROSS SECTION RENAMED C-J IN CCR.
 - GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.



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NEW JERSEY PENNSYLVANIA NEW YORK CONNECTICUT FLORIDA
NEVADA VIRGINIA CALIFORNIA

NJ Certificate of Authorization No: 24GA27996400

Project
SUNOCO PHILADELPHIA REFINERY
PHILADELPHIA COUNTY PENNSYLVANIA

Drawing Title
GEOLOGIC CROSS SECTION Z-Z' & GEOLOGIC CROSS SECTION BB-BB'

Project No. **2574601**
Date **8/26/10**
Scale **1" = 200' HOR. 1" = 10' VER.**
Dwn. By **JEM**
Last Revised **X**

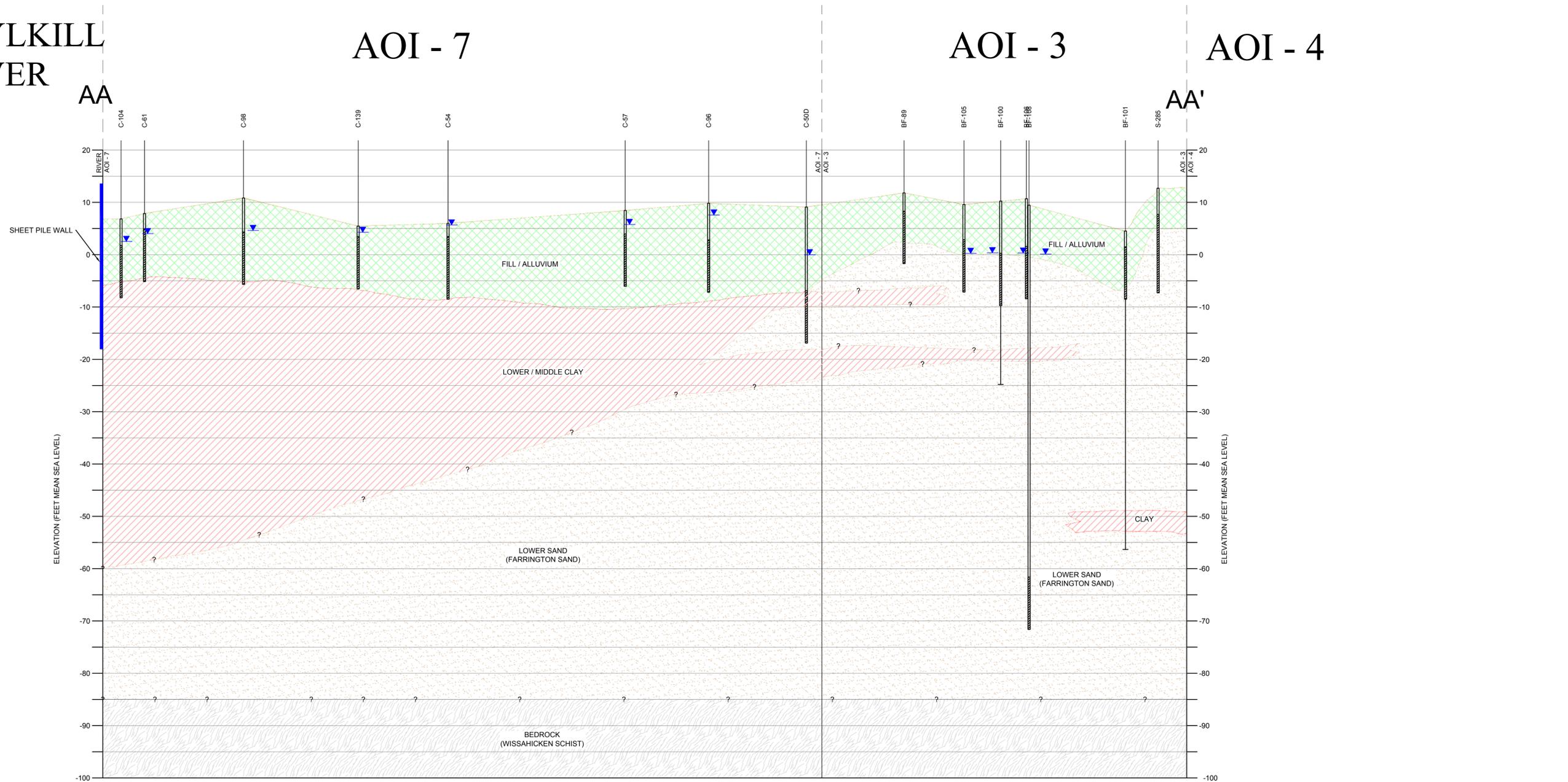
Figure No.
5A
Of

SCHUYLKILL RIVER

AOI - 7

AOI - 3

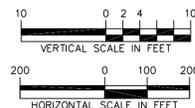
AOI - 4



- NOTES:**
- LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
 - DEPTH OF SHEET PILE WAS DETERMINED FROM FIGURE 2-8 GENERALIZED GEOLOGICAL CROSS SECTION A-C DATED NOVEMBER 13, 1992 FROM DAMES AND MOORE, RCRA VERIFICATION INVESTIGATION REPORT, CHEVRON REFINERY, 1992, CROSS SECTION RENAMED C-J IN CCR
 - GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.
 - THICKNESS OF LOWER / MIDDLE CLAY IN AOI-7 IS ESTIMATED FROM DEEP MONITORING WELLS C-144D, C-134D, AND C-50D.

LEGEND:

- FILL / ALLUVIUM
- SAND / GRAVEL (TRENTON GRAVEL)
- CLAY
- SAND
- BEDROCK (WISSAHICKON SCHIST)
- C-129D LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- BOTTOM OF BOREHOLE
- INFERRED CONTACTS
- GROUNDWATER LEVEL
- SHEET PILE WALL



Project
SUNOCO
PHILADELPHIA
REFINERY
PHILADELPHIA COUNTY PENNSYLVANIA

Drawing Title
GEOLOGIC CROSS SECTION AA-AA'

Project No.	2574601	Figure No.	5B
Date	8/26/10		
Scale	1" = 200' HOR. 1" = 10' VER.		
Drn. By	JEM		
Last Revised	X	Of	

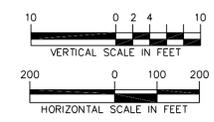
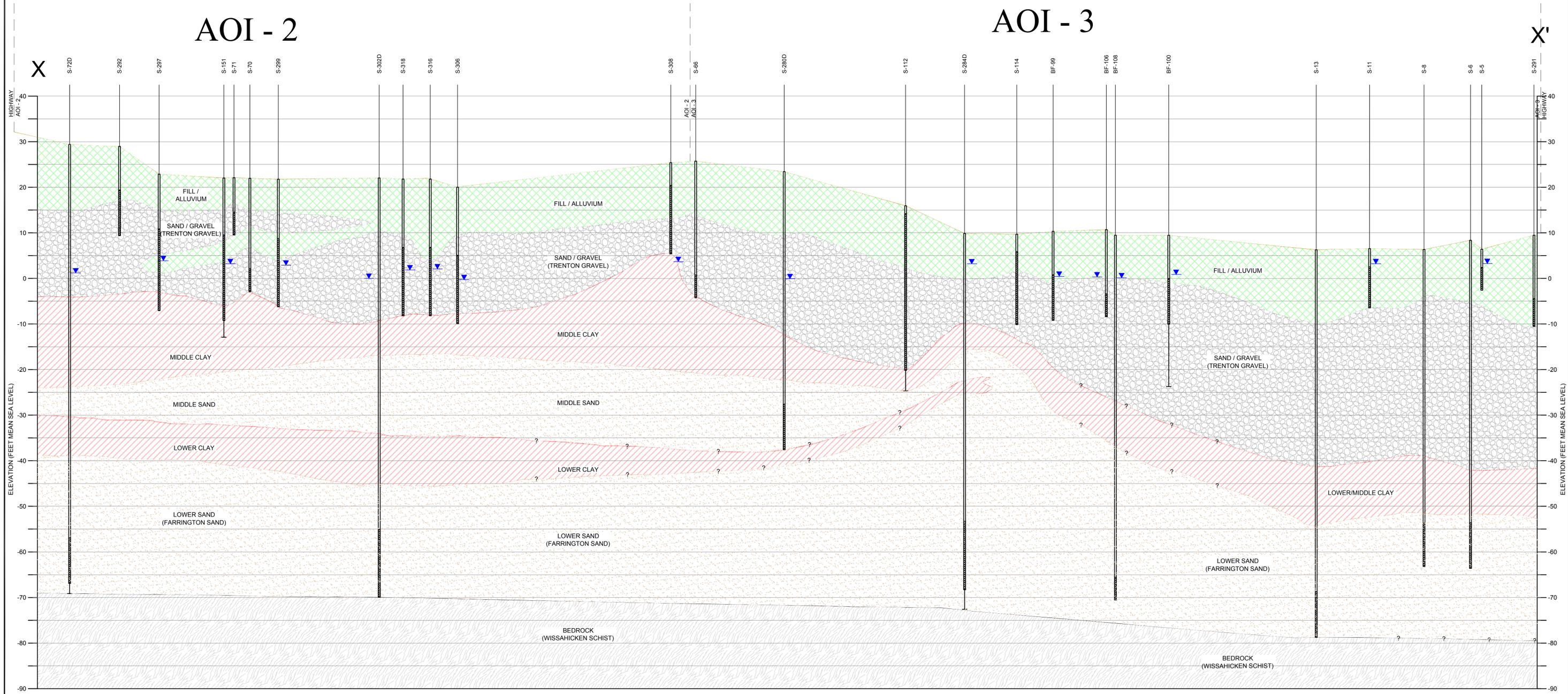
LEGEND:

-  FILL / ALLUVIUM
-  SAND / GRAVEL (TRENTON GRAVEL)
-  CLAY
-  SAND
-  BEDROCK (WISSAHICKON SCHIST)
-  WELL CASING/BOREHOLE
-  WELL SCREEN
-  BOTTOM OF BOREHOLE
-  INFERRED CONTACTS
-  GROUNDWATER LEVEL
-  SHEET PILE WALL

- NOTES:**
1. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
 2. WELL SCREEN INTERVAL INFORMATION NOT AVAILABEL FOR S-2 AND S-68
 3. GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.
 4. BORING LOG FOR BF-108 COULD NOT BE LOCATED. THICKNESS OF LOWER/MIDDLE CLAY IN THIS AREA IS ESTIMATED BASED UPON LOG S-284D AND S-13.

AOI - 2

AOI - 3

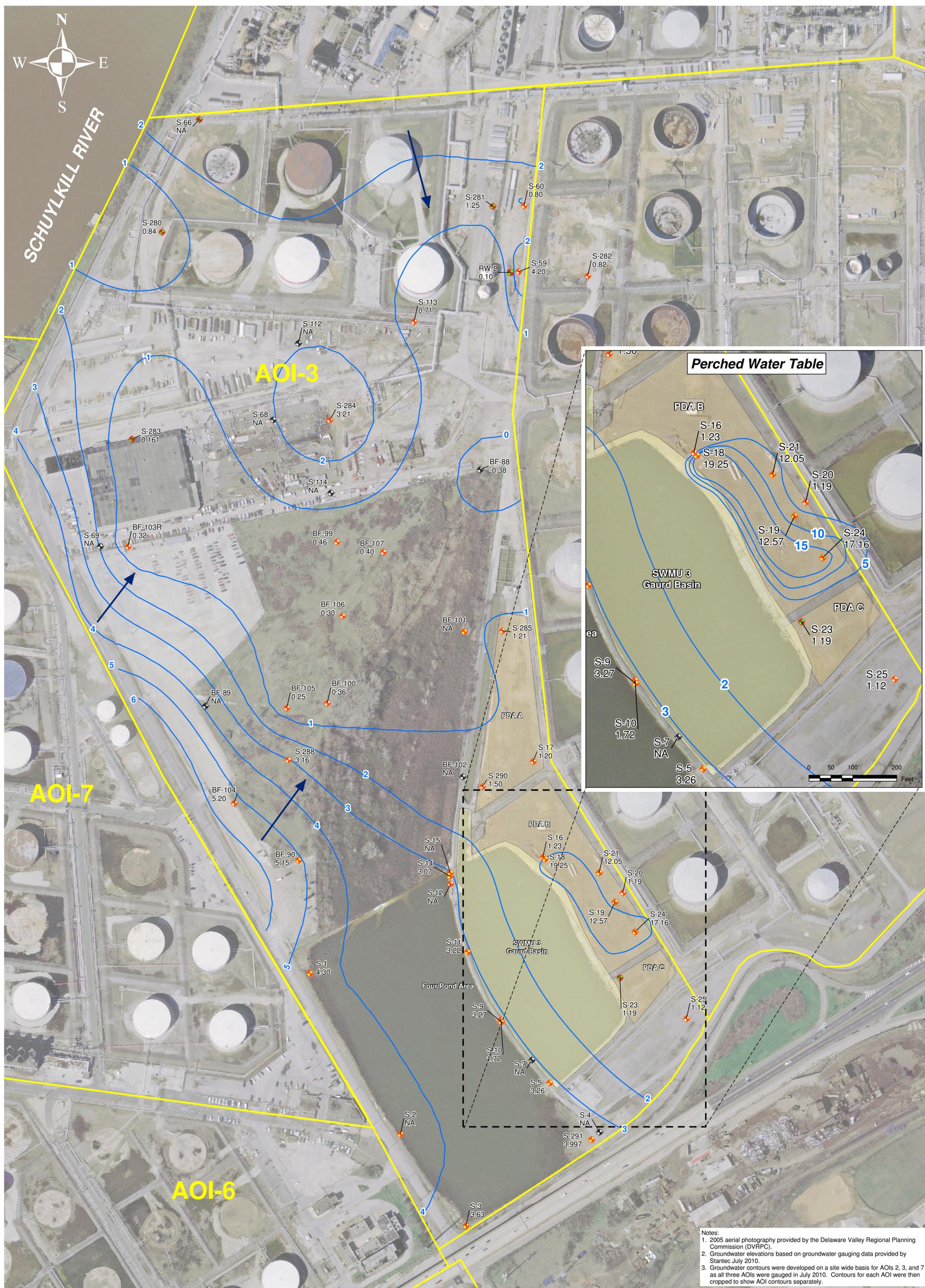


Project
SUNOCO
PHILADELPHIA
REFINERY
 PHILADELPHIA COUNTY PENNSYLVANIA

Drawing Title
GEOLOGIC CROSS
SECTION X-X'

Project No. **2574601**
 Date **8/26/10**
 Scale **1" = 200' HOR.**
1" = 10' VER.
 Drn. By **JEM**
 Last Revised **X**

Figure No.
5C
 Of



Notes:
 1. 2005 aerial photography provided by the Delaware Valley Regional Planning Commission (DVRPC).
 2. Groundwater elevations based on groundwater gauging data provided by Stantec July 2010.
 3. Groundwater contours were developed on a site wide basis for AOIs 2, 3, and 7 as all three AOIs were gauged in July 2010. Contours for each AOI were then cropped to show AOI contours separately.

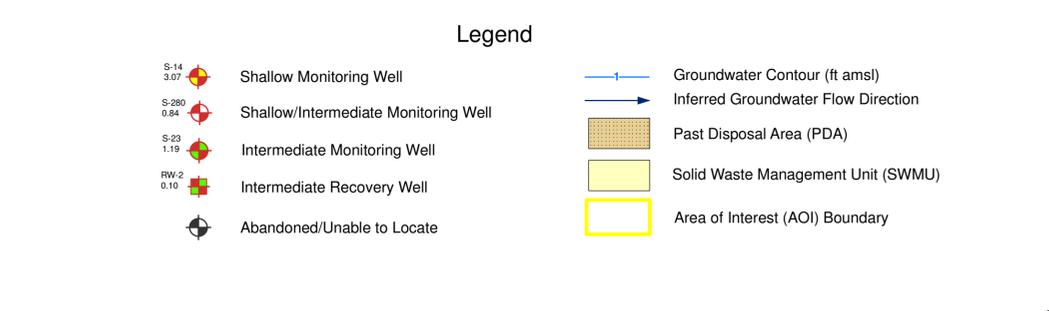
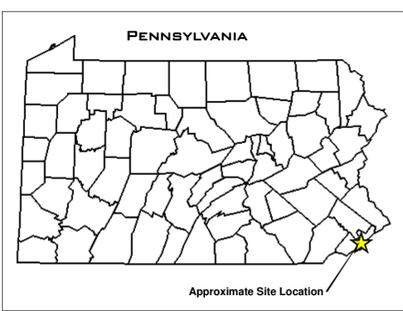


Figure 6: Shallow/Intermediate Groundwater Elevations
 AOI-3 Site Characterization/
 Remedial Investigation Report
 Sunoco Philadelphia Refinery
 Philadelphia, Pennsylvania

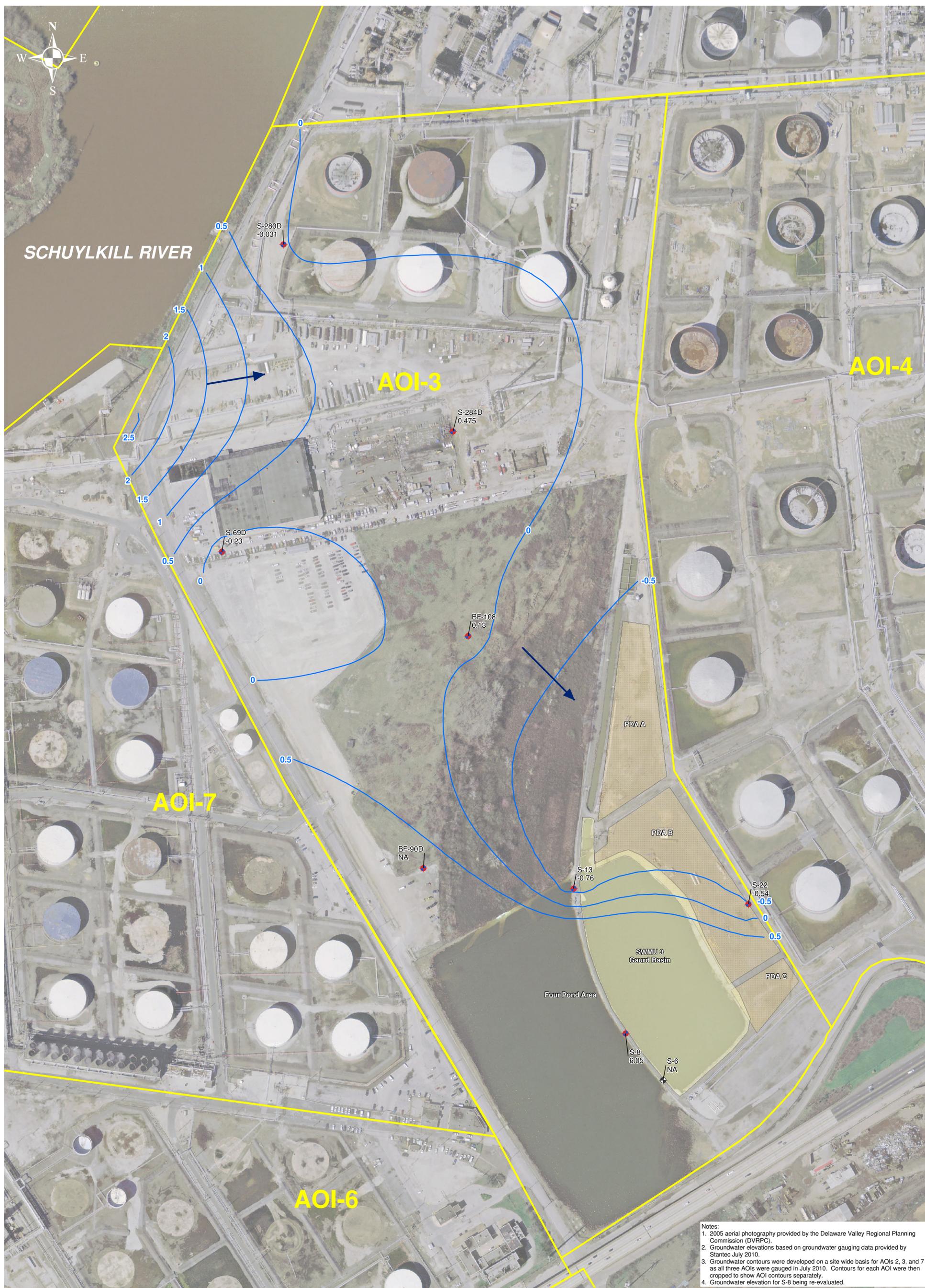
SUNOCO

Sunoco, Inc. (R&M)
 Philadelphia Refinery
 3144 Passyunk Avenue
 Philadelphia, PA.
 19145

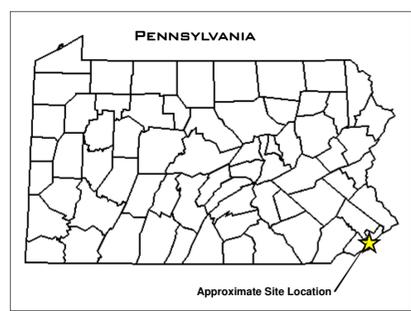
SCALE: 1" = 140'
 DATE: August 10, 2010
 DRN: BY: DMV
 CDD: BY: DMV
 JOB#: 2010001

0 70 140 280 Feet

Q:\data\2574601\ArcGIS\MapDocuments\AOI 3 SCR\Figure 6 - Shallow Intermediate GW Contours_rev9-2-10.mxd



Notes:
 1. 2005 aerial photography provided by the Delaware Valley Regional Planning Commission (DVRPC).
 2. Groundwater elevations based on groundwater gauging data provided by Stantec July 2010.
 3. Groundwater contours were developed on a site wide basis for AOIs 2, 3, and 7 as all three AOIs were gauged in July 2010. Contours for each AOI were then cropped to show AOI contours separately.
 4. Groundwater elevation for S-8 being re-evaluated.



Legend	
	Deep (Lower Sand) Monitoring Well
	Abandoned/Unable to Locate
	Groundwater Contour (ft amsl)
	Inferred Groundwater Flow Direction
	Past Disposal Area (PDA)
	Solid Waste Management Unit (SWMU)
	Area of Interest (AOI) Boundary

Figure 7: Deep (Lower Sand) Groundwater Elevations
 AOI-3 Site Characterization/
 Remedial Investigation Report
 Sunoco Philadelphia Refinery
 Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
 Philadelphia Refinery
 3144 Passyunk Avenue
 Philadelphia, PA.
 19145

SCALE: 1" = 140'
 DATE: August 10, 2010
 DRN: BY: SMI
 DTD: BY: DNV
 JOB#: 20100101

0 70 140 280 Feet

C:\data\2574601\ArcGIS\MapDocuments\AOI 3 SCR\Figure 7 - Deep GW Contours_rev8-18-10.mxd



SCHUYLKILL RIVER

AOI-3

AOI-4

AOI-7

AOI-6

PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Soil MSCs
 Benzene = 500 ug/kg
 Lead = 450 mg/kg

Site-Specific Standards Derived From Risk Assessment Analysis:
 Benzene = 2,160,000 ug/kg
 Lead = 3,140 mg/kg

S-285
 S-285 1-2
 Metals in mg/kg
 Lead (Total) - 536

BH-10-02 1-2
 Metals in mg/kg
 Lead (Total) - 5540

BH-10-01 1-2
 VOCs in ug/kg
 Benzene - 750

Notes:
 1. 2005 aerial photography provided by the Delaware Valley Regional Planning Commission (DVRPC).
 2. Soil Samples collected April-June 2010.



Legend

- New Shallow Soil Boring Location with No Exceedance of PADEP Non-Res Soil MSCs
- New Shallow Soil Boring Location with Exceedance of PADEP Non-Res Soil MSCs
- New Monitoring Well Location with Shallow Soil Sample Not Exceeding PADEP Non-Res Soil MSCs
- New Monitoring Well Location with Shallow Soil Sample Exceeding PADEP Non-Res Soil MSCs
- New Monitoring Well Location With No Shallow Soil Sample Collected
- Existing Monitoring Point
- Existing Recovery Well
- Abandoned/Damaged/Unable to Locate
- Lead Exceedance of Site Specific Standard (3,140 mg/kg)
- Area of Interest (AOI) Boundary
- Past Disposal Area (PDA)
- Solid Waste Management Unit (SWMU)

Figure 8: Summary of Soil Sample Exceedances
 AOI-3 Site Characterization/
 Remedial Investigation Report
 Sunoco Philadelphia Refinery
 Philadelphia, Pennsylvania

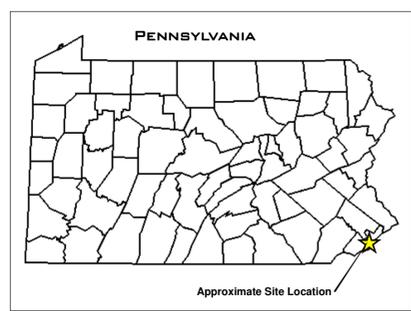
Sunoco, Inc. (R&M)
 Philadelphia Refinery
 3144 Passyunk Avenue
 Philadelphia, PA.
 19145

SCALE: 1" = 140'
 DATE: JUL 28, 2010
 DRN: BY: MAF
 CDD: BY: DNV
 JCS: 2010/07/01

0 70 140 280 Feet



Notes:
 1. 2005 aerial photography provided by the Delaware Valley Regional Planning Commission (DVRPC).
 2. Groundwater samples collected in July 2010 by Aquaterra.
 3. LNAPL occurrence based on July 2010 gauging event.



Legend

BF-106 VOCs in ug/L 1,2,4-TMB - 130 Benzene - 130	Shallow/Intermediate Monitoring Wells with Exceedance of PADEP Non-Res Groundwater MSCs	S-46	Monitoring Point Not Sampled
BF-108 VOCs in ug/L MTBE - 120	Deep (Lower Sand) Monitoring Well with Exceedance of PADEP Non-Res Groundwater MSCs	S-64	Abandoned/Damaged
S-21	Shallow/Intermediate Monitoring Well with LNAPL Occurrence	PDA	Past Disposal Area (PDA)
S-40	Shallow/Intermediate Monitoring Well with No Exceedance of PADEP Non-Res Groundwater MSCs	SWMU	Solid Waste Management Unit (SWMU)
S-400	Deep (Lower Sand) Well with No Exceedance of PADEP Non-Res Groundwater MSCs	AOI	Area of Interest (AOI) Boundary

Figure 9: Summary of Groundwater Sample Exceedances and LNAPL Occurrence AOI-3 Site Characterization/ Remedial Investigation Report Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
 Philadelphia Refinery
 3144 Passyunk Avenue
 Philadelphia, PA.
 19145

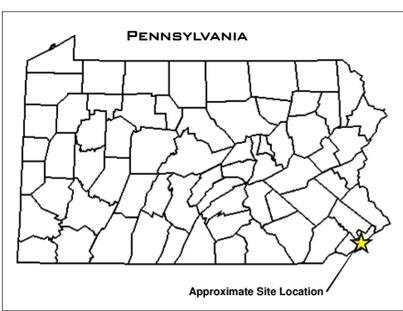
SCALE: 1" = 140'
 DATE: August 10, 2010
 DRN: BY: SWH
 CDD: BY: SWH
 JCS: 2010/08/10

0 70 140 280 Feet

Q:\data\2574601\ArcGIS\MapDocuments\AOI 3 SCR\Figure 9 - Summary of GW Exceedances_8-10-10.mxd



Notes:
 1. 2005 aerial photography provided by the Delaware Valley Regional Planning Commission (DVRPC).
 2. LNAPL thickness based on the July 2010 groundwater gauging event.



Legend	
	Shallow/Intermediate Monitoring Well with Apparent LNAPL Thickness (ft.)
	Shallow Monitoring Well with Apparent LNAPL Thickness (ft.)
	Intermediate Recovery Well with Apparent LNAPL Thickness (ft.)
	Monitoring Wells with No LNAPL
	Damaged/Abandoned/Unable to Locate
	Sheen Observed in Groundwater
	Area of Interest (AOI) Boundary
	Occupied Buildings
	Past Disposal Area (PDA)
	Solid Waste Management Unit (SWMU)
Light Non-Aqueous Phase Liquids (LNAPL) Types	
	Gas Middle Distillate
	Residual Oil
	Middle Distillate

Figure 10: Apparent LNAPL Thickness and Type
 AOI-3 Site Characterization/
 Remedial Investigation Report
 Sunoco Philadelphia Refinery
 Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
 Philadelphia Refinery
 3144 Passyunk Avenue
 Philadelphia, PA.
 19145

SCALE: 1" = 140'
 DATE: August 20, 2010
 DRN: BY: SHJ
 DTD: BY: SHJ
 JOB#: 2010011

0 70 140 280 Feet

Q:\data\2574601\ArcGIS\MapDocuments\AOI 3 SCR\Figure 10 - Apparent LNAPL Thickness_rev8-20-10.mxd

APPENDIX A

Current, Historic Use/Historic Investigation, and
Impervious Surface Plan

Please see separate file on CD

APPENDIX B

Soil Boring Logs and Monitoring Well Construction Summaries

APPENDIX C
USGS Plate 20

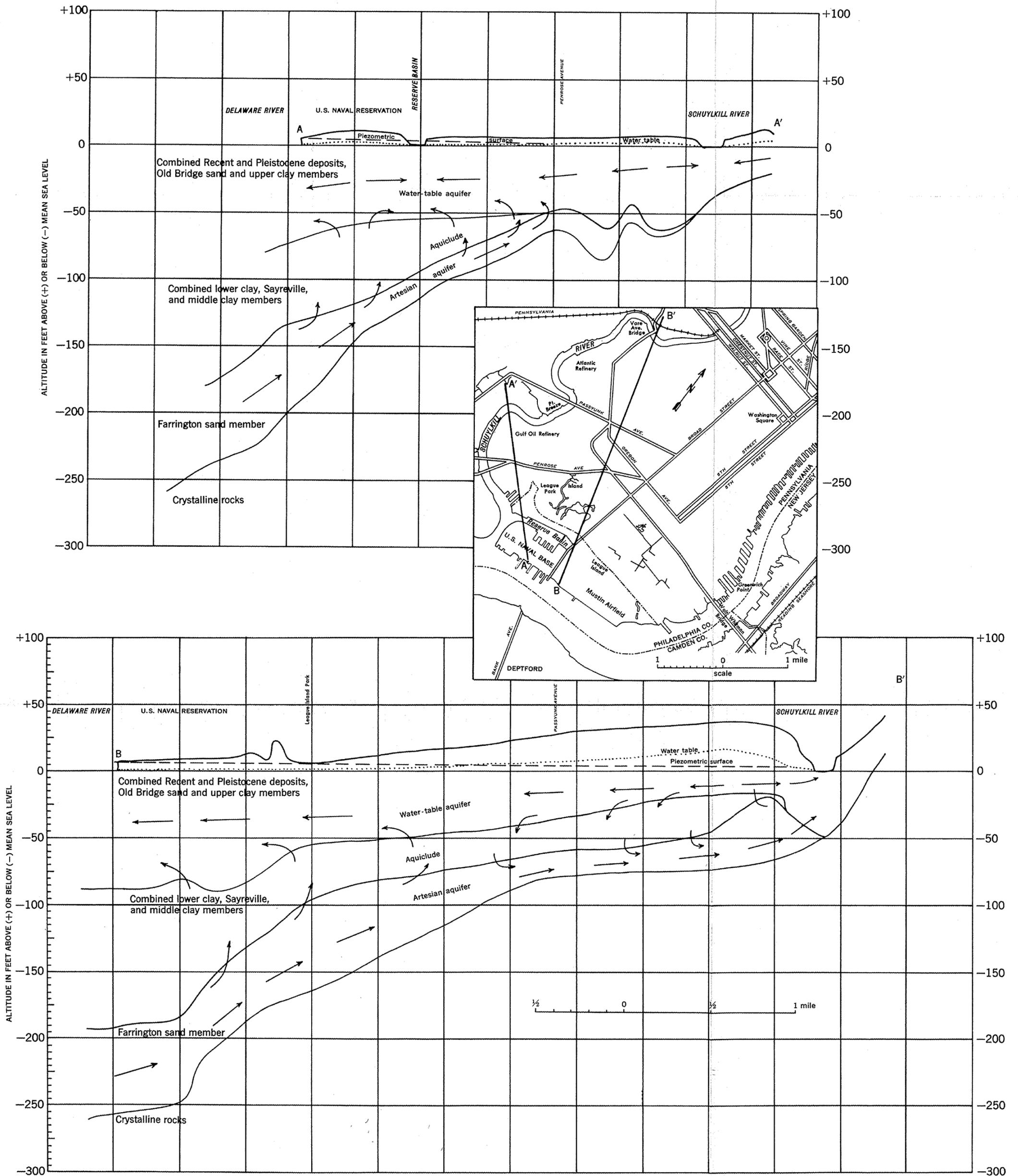


Plate 20 Cross sections showing probable directions of ground water movement in and between aquifers under natural conditions near the junction of the Delaware and Schuylkill Rivers in Pennsylvania.

APPENDIX D

Soil and Groundwater Analytical Reports (on CD)

REVISED

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 16, 2010

Project: SUN: Philadelphia Refinery AOI-3

Submittal Date: 04/29/2010
Group Number: 1192441
PO Number: PHILADELPHIA
State of Sample Origin: PA

<u>Client Sample Description</u>	<u>Lancaster Labs (LLI) #</u>
S-291_1-2' Grab Soil	5966974
BH-10-01_1-2' Grab Soil	5966975
BH-10-02_1-2' Grab Soil	5966976
BH-10-03_1-2' Grab Soil	5966977
S-290_1-2' Grab Soil	5966978
S-286_1-2' Grab Soil	5966979
S-285_1-2' Grab Soil	5966980
S-282_1-2' Grab Soil	5966981
S-280_1-2' Grab Soil	5966982
S-312_1-2' Grab Soil	5966983

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

REVISED

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,



Adrienne Kuhl
Specialist Group Leader



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Sample Description: S-291_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-291_1-2'

LLI Sample # SW 5966974
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/26/2010 11:20 by SS

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 04/29/2010 15:20

Reported: 07/16/2010 10:09

Discard: 09/15/2010

S-291

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10102	Benzene	71-43-2	< 4	4	0.4	0.8
10102	1,2-Dibromoethane	106-93-4	< 4	4	0.9	0.8
10102	1,2-Dichloroethane	107-06-2	< 4	4	0.9	0.8
10102	Ethylbenzene	100-41-4	< 4	4	0.9	0.8
10102	Isopropylbenzene	98-82-8	< 4	4	0.9	0.8
10102	Methyl Tertiary Butyl Ether	1634-04-4	< 4	4	0.4	0.8
10102	Toluene	108-88-3	< 4	4	0.9	0.8
10102	1,2,4-Trimethylbenzene	95-63-6	< 4	4	0.9	0.8
10102	1,3,5-Trimethylbenzene	108-67-8	< 4	4	0.9	0.8
10102	Xylene (Total)	1330-20-7	< 4	4	0.9	0.8
GC/MS Semivolatiles SW-846 8270C						
10724	Anthracene	120-12-7	< 180	180	36	1
10724	Benzo(a)anthracene	56-55-3	< 180	180	36	1
10724	Benzo(a)pyrene	50-32-8	< 180	180	36	1
10724	Benzo(b)fluoranthene	205-99-2	< 180	180	36	1
10724	Benzo(g,h,i)perylene	191-24-2	< 180	180	36	1
10724	Chrysene	218-01-9	< 180	180	36	1
10724	Fluorene	86-73-7	< 180	180	36	1
10724	Naphthalene	91-20-3	< 180	180	36	1
10724	Phenanthrene	85-01-8	< 180	180	36	1
10724	Pyrene	129-00-0	< 180	180	36	1
Metals SW-846 6020						
06135	Lead	7439-92-1	254	0.524	0.0786	5
Wet Chemistry SM20 2540 G						
00111	Moisture	n.a.	8.3	0.50	0.50	1
"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201012021001	04/26/2010 11:20	Client Supplied	1

*=This limit was used in the evaluation of the final result



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Page 2 of 2

REVISED

Sample Description: S-291_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-291_1-2'

LLI Sample # SW 5966974
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/26/2010 11:20 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

S-291

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201012021001	04/26/2010	11:20	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201012021001	04/26/2010	11:20	Client Supplied	1
10102	UST - Soils by 8260B	SW-846 8260B	1	X101231AA	05/03/2010	17:31	Emily R Styer	0.8
10724	PAH 8270 (microwave)	SW-846 8270C	1	10124SLI026	05/11/2010	05:54	Brian K Graham	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10124SLI026	05/05/2010	10:30	Olivia I Santiago	1
06135	Lead	SW-846 6020	1	101266150002A	05/10/2010	14:16	Choon Y Tian	5
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101266150002	05/06/2010	20:07	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10124820005B	05/04/2010	17:22	Scott W Freisher	1

*=This limit was used in the evaluation of the final result



Analysis Report

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Sample Description: BH-10-01_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 BH-10-01_1-2'

LLI Sample # SW 5966975
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/26/2010 13:00 by SS

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 04/29/2010 15:20

Reported: 07/16/2010 10:09

Discard: 09/15/2010

BH100

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Method Detection Limit*	Dry Limit of Quantitation	Dilution Factor
GC/MS	Volatiles	SW-846 8260B	ug/kg	ug/kg	ug/kg	
10102	Benzene	71-43-2	750	23	230	41.81
10102	1,2-Dibromoethane	106-93-4	N.D.	46	230	41.81
10102	1,2-Dichloroethane	107-06-2	N.D.	46	230	41.81
10102	Ethylbenzene	100-41-4	160	J 46	230	41.81
10102	Isopropylbenzene	98-82-8	3,000	46	230	41.81
10102	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	23	230	41.81
10102	Toluene	108-88-3	77	J 46	230	41.81
10102	1,2,4-Trimethylbenzene	95-63-6	220	J 46	230	41.81
10102	1,3,5-Trimethylbenzene	108-67-8	53	J 46	230	41.81
10102	Xylene (Total)	1330-20-7	310	46	230	41.81

GC/MS	Semivolatiles	SW-846 8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene	120-12-7	290	37	180	1
10724	Benzo(a)anthracene	56-55-3	290	37	180	1
10724	Benzo(a)pyrene	50-32-8	190	37	180	1
10724	Benzo(b)fluoranthene	205-99-2	230	37	180	1
10724	Benzo(g,h,i)perylene	191-24-2	200	37	180	1
10724	Chrysene	218-01-9	330	37	180	1
10724	Fluorene	86-73-7	670	37	180	1
10724	Naphthalene	91-20-3	230	37	180	1
10724	Phenanthrene	85-01-8	1,700	37	180	1
10724	Pyrene	129-00-0	650	37	180	1

Metals	SW-846 6020	mg/kg	mg/kg	mg/kg		
06135	Lead	7439-92-1	130	0.0808	0.539	5

Wet Chemistry	SM20 2540 G	%	%	%		
00111	Moisture	n.a.	9.0	0.50	0.50	1
"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201012021001	04/26/2010 13:00	Client Supplied	1

*=This limit was used in the evaluation of the final result



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Page 2 of 2

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Sample Description: BH-10-01_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 BH-10-01_1-2'

LLI Sample # SW 5966975
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/26/2010 13:00 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

BH100

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201012021001	04/26/2010	13:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201012021001	04/26/2010	13:00	Client Supplied	1
10102	UST - Soils by 8260B	SW-846 8260B	1	R101241AA	05/04/2010	18:20	Nicholas R Rossi	41.81
10724	PAH 8270 (microwave)	SW-846 8270C	1	10124SLI026	05/11/2010	07:09	Brian K Graham	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10124SLI026	05/05/2010	10:30	Olivia I Santiago	1
06135	Lead	SW-846 6020	1	101266150002A	05/10/2010	12:46	Choon Y Tian	5
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101266150002	05/06/2010	20:07	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10124820005B	05/04/2010	17:22	Scott W Freisher	1

*=This limit was used in the evaluation of the final result



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Sample Description: BH-10-02_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 BH-10-02_1-2'

LLI Sample # SW 5966976
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/26/2010 14:00 by SS

SUN: Aquaterra Tech.

Submitted: 04/29/2010 15:20

PO Box 744

Reported: 07/16/2010 10:09

West Chester PA 19381

Discard: 09/15/2010

BH102

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Method Detection Limit*	Dry Limit of Quantitation	Dilution Factor
GC/MS	Volatiles	SW-846 8260B	ug/kg	ug/kg	ug/kg	
10102	Benzene	71-43-2	300	29	290	49.96
10102	1,2-Dibromoethane	106-93-4	N.D.	59	290	49.96
10102	1,2-Dichloroethane	107-06-2	120	59	290	49.96
10102	Ethylbenzene	100-41-4	310	59	290	49.96
10102	Isopropylbenzene	98-82-8	N.D.	59	290	49.96
10102	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	29	290	49.96
10102	Toluene	108-88-3	910	59	290	49.96
10102	1,2,4-Trimethylbenzene	95-63-6	750	59	290	49.96
10102	1,3,5-Trimethylbenzene	108-67-8	330	59	290	49.96
10102	Xylene (Total)	1330-20-7	1,800	59	290	49.96

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Method Detection Limit*	Dry Limit of Quantitation	Dilution Factor
GC/MS	Semivolatiles	SW-846 8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene	120-12-7	100	39	200	1
10724	Benzo(a)anthracene	56-55-3	290	39	200	1
10724	Benzo(a)pyrene	50-32-8	290	39	200	1
10724	Benzo(b)fluoranthene	205-99-2	400	39	200	1
10724	Benzo(g,h,i)perylene	191-24-2	380	39	200	1
10724	Chrysene	218-01-9	430	39	200	1
10724	Fluorene	86-73-7	50	39	200	1
10724	Naphthalene	91-20-3	1,500	39	200	1
10724	Phenanthrene	85-01-8	430	39	200	1
10724	Pyrene	129-00-0	530	39	200	1

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Method Detection Limit*	Dry Limit of Quantitation	Dilution Factor
Metals	SW-846 6020		mg/kg	mg/kg	mg/kg	
06135	Lead	7439-92-1	5,540	1.70	11.3	100

CAT No.	Analysis Name	Method	Dry Result	Dry Method Detection Limit*	Dry Limit of Quantitation	Dilution Factor
Wet Chemistry	SM20 2540 G		%	%	%	
00111	Moisture	n.a.	15.0	0.50	0.50	1
"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201012021001	04/26/2010 14:00	Client Supplied	1

*=This limit was used in the evaluation of the final result



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Page 2 of 2

REVISED

Sample Description: BH-10-02_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 BH-10-02_1-2'

LLI Sample # SW 5966976
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/26/2010 14:00 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

BH102

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201012021001	04/26/2010	14:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201012021001	04/26/2010	14:00	Client Supplied	1
10102	UST - Soils by 8260B	SW-846 8260B	1	R101241AA	05/04/2010	19:05	Nicholas R Rossi	49.96
10724	PAH 8270 (microwave)	SW-846 8270C	1	10124SLI026	05/11/2010	07:33	Brian K Graham	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10124SLI026	05/05/2010	10:30	Olivia I Santiago	1
06135	Lead	SW-846 6020	1	101266150002A	05/10/2010	12:54	Choon Y Tian	100
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101266150002	05/06/2010	20:07	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10124820005B	05/04/2010	17:22	Scott W Freisher	1

*=This limit was used in the evaluation of the final result



Analysis Report

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Page 1 of 2

REVISED

Sample Description: BH-10-03_1-2' Grab Soil
 Philadelphia Refinery AOI-3
 COC: 193381 BH-10-03_1-2'

LLI Sample # SW 5966977
 LLI Group # 1192441
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/27/2010 08:30 by SS

SUN: Aquaterra Tech.

Submitted: 04/29/2010 15:20

PO Box 744

Reported: 07/16/2010 10:09

West Chester PA 19381

Discard: 09/15/2010

BH103

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846 8260B	ug/kg	ug/kg	ug/kg	
10102	Benzene	71-43-2	< 5	5	0.5	0.88
10102	1,2-Dibromoethane	106-93-4	< 5	5	1	0.88
10102	1,2-Dichloroethane	107-06-2	< 5	5	1	0.88
10102	Ethylbenzene	100-41-4	< 5	5	1	0.88
10102	Isopropylbenzene	98-82-8	< 5	5	1	0.88
10102	Methyl Tertiary Butyl Ether	1634-04-4	< 5	5	0.5	0.88
10102	Toluene	108-88-3	< 5	5	1	0.88
10102	1,2,4-Trimethylbenzene	95-63-6	< 5	5	1	0.88
10102	1,3,5-Trimethylbenzene	108-67-8	< 5	5	1	0.88
10102	Xylene (Total)	1330-20-7	< 5	5	1	0.88

The GC/MS volatile internal standard peak areas were outside the QC limits. The analysis was repeated and poor surrogate recoveries were observed confirming the matrix effect. The values reported here are from the initial analysis of the sample.

GC/MS	Semivolatiles	SW-846 8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene	120-12-7	< 200	200	39	1
10724	Benzo(a)anthracene	56-55-3	< 200	200	39	1
10724	Benzo(a)pyrene	50-32-8	< 200	200	39	1
10724	Benzo(b)fluoranthene	205-99-2	< 200	200	39	1
10724	Benzo(g,h,i)perylene	191-24-2	< 200	200	39	1
10724	Chrysene	218-01-9	200	200	39	1
10724	Fluorene	86-73-7	< 200	200	39	1
10724	Naphthalene	91-20-3	< 200	200	39	1
10724	Phenanthrene	85-01-8	200	200	39	1
10724	Pyrene	129-00-0	330	200	39	1

Metals	SW-846 6020	mg/kg	mg/kg	mg/kg	
06135 Lead	7439-92-1	73.9	0.237	0.0355	2

Wet Chemistry	SM20 2540 G	%	%	%	
00111 Moisture	n.a.	15.5	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result



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Page 2 of 2

REVISED

Sample Description: BH-10-03_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 BH-10-03_1-2'

LLI Sample # SW 5966977
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/27/2010 08:30 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

BH103

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201012021001	04/27/2010	08:30	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201012021001	04/27/2010	08:30	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201012021001	04/27/2010	08:30	Client Supplied	1
10102	UST - Soils by 8260B	SW-846 8260B	1	X101231AA	05/03/2010	17:54	Emily R Styer	0.88
10724	PAH 8270 (microwave)	SW-846 8270C	1	10124SLI026	05/11/2010	07:58	Brian K Graham	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10124SLI026	05/05/2010	10:30	Olivia I Santiago	1
06135	Lead	SW-846 6020	1	101266150002A	05/10/2010	12:01	Choon Y Tian	2
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101266150002	05/06/2010	20:07	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10124820005B	05/04/2010	17:22	Scott W Freisher	1

*=This limit was used in the evaluation of the final result



Analysis Report

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Page 1 of 2

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Sample Description: S-290_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-290_1-2'

LLI Sample # SW 5966978
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/27/2010 09:15 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

S-290

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Method Detection Limit*	Dry Limit of Quantitation	Dilution Factor
GC/MS	Volatiles	SW-846 8260B	ug/kg	ug/kg	ug/kg	
10102	Benzene	71-43-2	34 J	31	310	52.82
10102	1,2-Dibromoethane	106-93-4	N.D.	63	310	52.82
10102	1,2-Dichloroethane	107-06-2	N.D.	63	310	52.82
10102	Ethylbenzene	100-41-4	N.D.	63	310	52.82
10102	Isopropylbenzene	98-82-8	N.D.	63	310	52.82
10102	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	31	310	52.82
10102	Toluene	108-88-3	N.D.	63	310	52.82
10102	1,2,4-Trimethylbenzene	95-63-6	79 J	63	310	52.82
10102	1,3,5-Trimethylbenzene	108-67-8	N.D.	63	310	52.82
10102	Xylene (Total)	1330-20-7	120 J	63	310	52.82

The GC/MS volatile analysis was performed according to the high level soil method due to the level of non-target compounds. Therefore, the reporting limits were raised.

GC/MS	Semivolatiles	SW-846 8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene	120-12-7	N.D.	400	2,000	10
10724	Benzo(a)anthracene	56-55-3	620 J	400	2,000	10
10724	Benzo(a)pyrene	50-32-8	N.D.	400	2,000	10
10724	Benzo(b)fluoranthene	205-99-2	480 J	400	2,000	10
10724	Benzo(g,h,i)perylene	191-24-2	N.D.	400	2,000	10
10724	Chrysene	218-01-9	810 J	400	2,000	10
10724	Fluorene	86-73-7	N.D.	400	2,000	10
10724	Naphthalene	91-20-3	N.D.	400	2,000	10
10724	Phenanthrene	85-01-8	820 J	400	2,000	10
10724	Pyrene	129-00-0	1,100 J	400	2,000	10

Due to the sample matrix an initial dilution was necessary to perform the analysis. Therefore, the reporting limits for the GC/MS semivolatiles compounds were raised.

Metals	SW-846 6020	mg/kg	mg/kg	mg/kg	
06135 Lead	7439-92-1	320	0.171	1.14	10

Wet Chemistry	SM20 2540 G	%	%	%	
00111 Moisture	n.a.	15.7	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result



Analysis Report

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Page 2 of 2

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Sample Description: S-290_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-290_1-2'

LLI Sample # SW 5966978
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/27/2010 09:15 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

S-290

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201012021001	04/27/2010	09:15	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201012021001	04/27/2010	09:15	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201012021001	04/27/2010	09:15	Client Supplied	1
10102	UST - Soils by 8260B	SW-846 8260B	1	R101241AA	05/04/2010	19:27	Nicholas R Rossi	52.82
10724	PAH 8270 (microwave)	SW-846 8270C	1	10124SLI026	05/11/2010	08:23	Brian K Graham	10
10814	BNA Soil Microwave PAH	SW-846 3546	1	10124SLI026	05/05/2010	10:30	Olivia I Santiago	1
06135	Lead	SW-846 6020	1	101266150002A	05/10/2010	12:42	Choon Y Tian	10
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101266150002	05/06/2010	20:07	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10124820005B	05/04/2010	17:22	Scott W Freisher	1

*=This limit was used in the evaluation of the final result



Analysis Report

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Sample Description: S-286_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-286_1-2'

LLI Sample # SW 5966979
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/27/2010 11:45 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

S-286

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Method Detection Limit*	Dry Limit of Quantitation	Dilution Factor
GC/MS	Volatiles	SW-846 8260B	ug/kg	ug/kg	ug/kg	
10102	Benzene	71-43-2	31 J	28	280	47.48
10102	1,2-Dibromoethane	106-93-4	N.D.	55	280	47.48
10102	1,2-Dichloroethane	107-06-2	N.D.	55	280	47.48
10102	Ethylbenzene	100-41-4	N.D.	55	280	47.48
10102	Isopropylbenzene	98-82-8	N.D.	55	280	47.48
10102	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	28	280	47.48
10102	Toluene	108-88-3	N.D.	55	280	47.48
10102	1,2,4-Trimethylbenzene	95-63-6	N.D.	55	280	47.48
10102	1,3,5-Trimethylbenzene	108-67-8	N.D.	55	280	47.48
10102	Xylene (Total)	1330-20-7	N.D.	55	280	47.48

The GC/MS volatile analysis was performed according to the high level soil method due to the level of non-target compounds. Therefore, the reporting limits were raised.

GC/MS	Semivolatiles	SW-846 8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene	120-12-7	2,100	390	1,900	10
10724	Benzo(a)anthracene	56-55-3	2,600	390	1,900	10
10724	Benzo(a)pyrene	50-32-8	1,400 J	390	1,900	10
10724	Benzo(b)fluoranthene	205-99-2	2,000	390	1,900	10
10724	Benzo(g,h,i)perylene	191-24-2	1,100 J	390	1,900	10
10724	Chrysene	218-01-9	2,400	390	1,900	10
10724	Fluorene	86-73-7	N.D.	390	1,900	10
10724	Naphthalene	91-20-3	N.D.	390	1,900	10
10724	Phenanthrene	85-01-8	3,800	390	1,900	10
10724	Pyrene	129-00-0	5,300	390	1,900	10

Due to the sample matrix an initial dilution was necessary to perform the analysis. Therefore, the reporting limits for the GC/MS semivolatiles compounds were raised.

Metals	SW-846 6020	mg/kg	mg/kg	mg/kg		
06135	Lead	7439-92-1	151	0.0856	0.571	5

Wet Chemistry	SM20 2540 G	%	%	%		
00111	Moisture	n.a.	14.1	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result



Analysis Report

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Page 2 of 2

REVISED

Sample Description: S-286_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-286_1-2'

LLI Sample # SW 5966979
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/27/2010 11:45 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

S-286

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201012021001	04/27/2010	11:45	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201012021001	04/27/2010	11:45	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201012021001	04/27/2010	11:45	Client Supplied	1
10102	UST - Soils by 8260B	SW-846 8260B	1	R101241AA	05/04/2010	19:50	Nicholas R Rossi	47.48
10724	PAH 8270 (microwave)	SW-846 8270C	1	10124SLI026	05/11/2010	08:48	Brian K Graham	10
10814	BNA Soil Microwave PAH	SW-846 3546	1	10124SLI026	05/05/2010	10:30	Olivia I Santiago	1
06135	Lead	SW-846 6020	1	101266150002A	05/10/2010	12:43	Choon Y Tian	5
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101266150002	05/06/2010	20:07	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10124820005B	05/04/2010	17:22	Scott W Freisher	1

*=This limit was used in the evaluation of the final result



Analysis Report

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Page 1 of 2
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Sample Description: S-285_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-285_1-2'

LLI Sample # SW 5966980
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/27/2010 13:30 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

S-285

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846 8260B	ug/kg	ug/kg	ug/kg	
10102	Benzene	71-43-2	17	5	0.5	0.89
10102	1,2-Dibromoethane	106-93-4	< 5	5	1	0.89
10102	1,2-Dichloroethane	107-06-2	< 5	5	1	0.89
10102	Ethylbenzene	100-41-4	< 5	5	1	0.89
10102	Isopropylbenzene	98-82-8	< 5	5	1	0.89
10102	Methyl Tertiary Butyl Ether	1634-04-4	< 5	5	0.5	0.89
10102	Toluene	108-88-3	< 5	5	1	0.89
10102	1,2,4-Trimethylbenzene	95-63-6	< 5	5	1	0.89
10102	1,3,5-Trimethylbenzene	108-67-8	< 5	5	1	0.89
10102	Xylene (Total)	1330-20-7	10	5	1	0.89

The GC/MS volatile internal standard peak areas were outside the QC limits for both the initial analysis and the re-analysis. The values reported here are from the initial analysis of the sample.

GC/MS	Semivolatiles	SW-846 8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene	120-12-7	< 4,000	4,000	790	10
10724	Benzo(a)anthracene	56-55-3	< 4,000	4,000	790	10
10724	Benzo(a)pyrene	50-32-8	< 4,000	4,000	790	10
10724	Benzo(b)fluoranthene	205-99-2	< 4,000	4,000	790	10
10724	Benzo(g,h,i)perylene	191-24-2	< 4,000	4,000	790	10
10724	Chrysene	218-01-9	< 4,000	4,000	790	10
10724	Fluorene	86-73-7	< 4,000	4,000	790	10
10724	Naphthalene	91-20-3	< 4,000	4,000	790	10
10724	Phenanthrene	85-01-8	< 4,000	4,000	790	10
10724	Pyrene	129-00-0	< 4,000	4,000	790	10

Due to the sample matrix an initial dilution was necessary to perform the analysis. Therefore, the reporting limits for the GC/MS semivolatiles compounds were raised.

Due to sample matrix interferences observed during the extraction, the normal reporting limits were not attained.

Metals	SW-846 6020	mg/kg	mg/kg	mg/kg	
06135 Lead	7439-92-1	536	2.31	0.347	20

Wet Chemistry	SM20 2540 G	%	%	%	
00111 Moisture	n.a.	16.1	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result



Analysis Report

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Page 2 of 2

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Sample Description: S-285_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-285_1-2'

LLI Sample # SW 5966980
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/27/2010 13:30 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

S-285

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201012021001	04/27/2010 13:30	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201012021001	04/27/2010 13:30	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201012021001	04/27/2010 13:30	Client Supplied	1
10102	UST - Soils by 8260B	SW-846 8260B	1	X101231AA	05/03/2010 18:17	Emily R Styer	0.89
10724	PAH 8270 (microwave)	SW-846 8270C	1	10124SLI026	05/11/2010 09:13	Brian K Graham	10
10814	BNA Soil Microwave PAH	SW-846 3546	1	10124SLI026	05/05/2010 10:30	Olivia I Santiago	1
06135	Lead	SW-846 6020	1	101266150002A	05/10/2010 12:45	Choon Y Tian	20
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101266150002	05/06/2010 20:07	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10124820005B	05/04/2010 17:22	Scott W Freisher	1

*=This limit was used in the evaluation of the final result



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Sample Description: S-282_1-2' Grab Soil
 Philadelphia Refinery AOI-3
 COC: 193381 S-282_1-2'

LLI Sample # SW 5966981
 LLI Group # 1192441
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/27/2010 15:00 by SS

SUN: Aquaterra Tech.

Submitted: 04/29/2010 15:20

PO Box 744

Reported: 07/16/2010 10:09

West Chester PA 19381

Discard: 09/15/2010

S-282

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10102	Benzene	71-43-2	< 4	4	0.4	0.76
10102	1,2-Dibromoethane	106-93-4	< 4	4	0.9	0.76
10102	1,2-Dichloroethane	107-06-2	< 4	4	0.9	0.76
10102	Ethylbenzene	100-41-4	< 4	4	0.9	0.76
10102	Isopropylbenzene	98-82-8	< 4	4	0.9	0.76
10102	Methyl Tertiary Butyl Ether	1634-04-4	< 4	4	0.4	0.76
10102	Toluene	108-88-3	< 4	4	0.9	0.76
10102	1,2,4-Trimethylbenzene	95-63-6	< 4	4	0.9	0.76
10102	1,3,5-Trimethylbenzene	108-67-8	< 4	4	0.9	0.76
10102	Xylene (Total)	1330-20-7	< 4	4	0.9	0.76
GC/MS Semivolatiles SW-846 8270C						
10724	Anthracene	120-12-7	< 200	200	40	1
10724	Benzo(a)anthracene	56-55-3	< 200	200	40	1
10724	Benzo(a)pyrene	50-32-8	< 200	200	40	1
10724	Benzo(b)fluoranthene	205-99-2	< 200	200	40	1
10724	Benzo(g,h,i)perylene	191-24-2	< 200	200	40	1
10724	Chrysene	218-01-9	< 200	200	40	1
10724	Fluorene	86-73-7	< 200	200	40	1
10724	Naphthalene	91-20-3	< 200	200	40	1
10724	Phenanthrene	85-01-8	< 200	200	40	1
10724	Pyrene	129-00-0	< 200	200	40	1
Metals SW-846 6020						
06135	Lead	7439-92-1	87.3	0.229	0.0343	2
Wet Chemistry SM20 2540 G						
00111	Moisture	n.a.	15.9	0.50	0.50	1
"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201012021001	04/27/2010 15:00	Client Supplied	1

*=This limit was used in the evaluation of the final result



Analysis Report

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Page 2 of 2

REVISED

Sample Description: S-282_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-282_1-2'

LLI Sample # SW 5966981
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/27/2010 15:00 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

S-282

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201012021001	04/27/2010	15:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201012021001	04/27/2010	15:00	Client Supplied	1
10102	UST - Soils by 8260B	SW-846 8260B	1	X101231AA	05/03/2010	18:39	Emily R Styer	0.76
10724	PAH 8270 (microwave)	SW-846 8270C	1	10124SLI026	05/11/2010	09:38	Brian K Graham	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10124SLI026	05/05/2010	10:30	Olivia I Santiago	1
06135	Lead	SW-846 6020	1	101266150002A	05/10/2010	12:07	Choon Y Tian	2
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101266150002	05/06/2010	20:07	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10124820005B	05/04/2010	17:22	Scott W Freisher	1

*=This limit was used in the evaluation of the final result



Analysis Report

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Sample Description: S-280_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-280_1-2'

LLI Sample # SW 5966982
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/28/2010 09:45 by SS

SUN: Aquaterra Tech.

Submitted: 04/29/2010 15:20

PO Box 744

Reported: 07/16/2010 10:09

West Chester PA 19381

Discard: 09/15/2010

S-280

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10102	Benzene	71-43-2	< 5	5	0.5	0.82
10102	1,2-Dibromoethane	106-93-4	< 5	5	0.9	0.82
10102	1,2-Dichloroethane	107-06-2	< 5	5	0.9	0.82
10102	Ethylbenzene	100-41-4	< 5	5	0.9	0.82
10102	Isopropylbenzene	98-82-8	< 5	5	0.9	0.82
10102	Methyl Tertiary Butyl Ether	1634-04-4	< 5	5	0.5	0.82
10102	Toluene	108-88-3	< 5	5	0.9	0.82
10102	1,2,4-Trimethylbenzene	95-63-6	< 5	5	0.9	0.82
10102	1,3,5-Trimethylbenzene	108-67-8	< 5	5	0.9	0.82
10102	Xylene (Total)	1330-20-7	< 5	5	0.9	0.82
GC/MS Semivolatiles SW-846 8270C						
10724	Anthracene	120-12-7	< 190	190	39	1
10724	Benzo(a)anthracene	56-55-3	300	190	39	1
10724	Benzo(a)pyrene	50-32-8	220	190	39	1
10724	Benzo(b)fluoranthene	205-99-2	290	190	39	1
10724	Benzo(g,h,i)perylene	191-24-2	< 190	190	39	1
10724	Chrysene	218-01-9	300	190	39	1
10724	Fluorene	86-73-7	< 190	190	39	1
10724	Naphthalene	91-20-3	< 190	190	39	1
10724	Phenanthrene	85-01-8	240	190	39	1
10724	Pyrene	129-00-0	480	190	39	1
Metals SW-846 6020						
06135	Lead	7439-92-1	266	1.13	0.169	10
Wet Chemistry SM20 2540 G						
00111	Moisture	n.a.	13.9	0.50	0.50	1
"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201012021001	04/28/2010 09:45	Client Supplied	1

*=This limit was used in the evaluation of the final result



Analysis Report

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Page 2 of 2

REVISED

Sample Description: S-280_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-280_1-2'

LLI Sample # SW 5966982
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/28/2010 09:45 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

S-280

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201012021001	04/28/2010	09:45	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201012021001	04/28/2010	09:45	Client Supplied	1
10102	UST - Soils by 8260B	SW-846 8260B	1	X101231AA	05/03/2010	19:02	Emily R Styer	0.82
10724	PAH 8270 (microwave)	SW-846 8270C	1	10124SLJ026	05/07/2010	18:20	Ryan P Byrne	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10124SLJ026	05/05/2010	10:30	Olivia I Santiago	1
06135	Lead	SW-846 6020	1	101266150002A	05/10/2010	12:49	Choon Y Tian	10
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101266150002	05/06/2010	20:07	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10124820005B	05/04/2010	17:22	Scott W Freisher	1

*=This limit was used in the evaluation of the final result



Analysis Report

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Page 1 of 2

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Sample Description: S-312_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-312_1-2'

LLI Sample # SW 5966983
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/28/2010 13:00 by SS

SUN: Aquaterra Tech.

Submitted: 04/29/2010 15:20

PO Box 744

Reported: 07/16/2010 10:09

West Chester PA 19381

Discard: 09/15/2010

S-312

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10102	Benzene	71-43-2	< 5	5	0.5	0.78
10102	1,2-Dibromoethane	106-93-4	< 5	5	0.9	0.78
10102	1,2-Dichloroethane	107-06-2	< 5	5	0.9	0.78
10102	Ethylbenzene	100-41-4	< 5	5	0.9	0.78
10102	Isopropylbenzene	98-82-8	< 5	5	0.9	0.78
10102	Methyl Tertiary Butyl Ether	1634-04-4	< 5	5	0.5	0.78
10102	Toluene	108-88-3	< 5	5	0.9	0.78
10102	1,2,4-Trimethylbenzene	95-63-6	< 5	5	0.9	0.78
10102	1,3,5-Trimethylbenzene	108-67-8	< 5	5	0.9	0.78
10102	Xylene (Total)	1330-20-7	< 5	5	0.9	0.78
GC/MS Semivolatiles SW-846 8270C						
10724	Anthracene	120-12-7	< 200	200	40	1
10724	Benzo(a)anthracene	56-55-3	< 200	200	40	1
10724	Benzo(a)pyrene	50-32-8	< 200	200	40	1
10724	Benzo(b)fluoranthene	205-99-2	< 200	200	40	1
10724	Benzo(g,h,i)perylene	191-24-2	< 200	200	40	1
10724	Chrysene	218-01-9	< 200	200	40	1
10724	Fluorene	86-73-7	< 200	200	40	1
10724	Naphthalene	91-20-3	< 200	200	40	1
10724	Phenanthrene	85-01-8	< 200	200	40	1
10724	Pyrene	129-00-0	< 200	200	40	1
Metals SW-846 6020						
06135	Lead	7439-92-1	54.2	0.235	0.0352	2
Wet Chemistry SM20 2540 G						
00111	Moisture	n.a.	16.5	0.50	0.50	1
"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201012021001	04/28/2010 13:00	Client Supplied	1

*=This limit was used in the evaluation of the final result



Analysis Report

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Page 2 of 2

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Sample Description: S-312_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 193381 S-312_1-2'

LLI Sample # SW 5966983
LLI Group # 1192441
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 04/28/2010 13:00 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 04/29/2010 15:20

West Chester PA 19381

Reported: 07/16/2010 10:09

Discard: 09/15/2010

S-312

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201012021001	04/28/2010	13:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201012021001	04/28/2010	13:00	Client Supplied	1
10102	UST - Soils by 8260B	SW-846 8260B	1	X101231AA	05/03/2010	19:25	Emily R Styer	0.78
10724	PAH 8270 (microwave)	SW-846 8270C	1	10124SLJ026	05/07/2010	18:44	Ryan P Byrne	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10124SLJ026	05/05/2010	10:30	Olivia I Santiago	1
06135	Lead	SW-846 6020	1	101266150002A	05/10/2010	12:13	Choon Y Tian	2
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101266150002	05/06/2010	20:07	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10124820005B	05/04/2010	17:22	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 07/16/10 at 10:09 AM

Group Number: 1192441

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: X101231AA	Sample number(s): 5966974, 5966977, 5966980-5966983								
Benzene	< 5	5.	0.5	ug/kg	102	96	80-120	6	30
1,2-Dibromoethane	< 5	5.	1	ug/kg	96	92	80-120	4	30
1,2-Dichloroethane	< 5	5.	1	ug/kg	104	99	71-129	5	30
Ethylbenzene	< 5	5.	1	ug/kg	101	95	80-120	6	30
Isopropylbenzene	< 5	5.	1	ug/kg	100	96	76-120	5	30
Methyl Tertiary Butyl Ether	< 5	5.	0.5	ug/kg	105	103	74-121	2	30
Toluene	< 5	5.	1	ug/kg	99	94	80-120	5	30
1,2,4-Trimethylbenzene	< 5	5.	1	ug/kg	100	94	79-120	7	30
1,3,5-Trimethylbenzene	< 5	5.	1	ug/kg	100	95	78-120	5	30
Xylene (Total)	< 5	5.	1	ug/kg	101	95	80-120	6	30

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank MDL**</u>	<u>Blank LOQ</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: R101241AA	Sample number(s): 5966975-5966976, 5966978-5966979								
Benzene	N.D.	25.	250	ug/kg	91	89	80-120	2	30
1,2-Dibromoethane	N.D.	50.	250	ug/kg	94	91	80-120	2	30
1,2-Dichloroethane	N.D.	50.	250	ug/kg	95	94	71-129	2	30
Ethylbenzene	N.D.	50.	250	ug/kg	92	89	80-120	4	30
Isopropylbenzene	N.D.	50.	250	ug/kg	93	90	76-120	3	30
Methyl Tertiary Butyl Ether	N.D.	25.	250	ug/kg	112	108	74-121	3	30
Toluene	N.D.	50.	250	ug/kg	95	90	80-120	5	30
1,2,4-Trimethylbenzene	N.D.	50.	250	ug/kg	91	89	79-120	2	30
1,3,5-Trimethylbenzene	N.D.	50.	250	ug/kg	87	85	78-120	3	30
Xylene (Total)	N.D.	50.	250	ug/kg	93	90	80-120	4	30

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: 10124SLJ026	Sample number(s): 5966982-5966983								
Anthracene	< 170	170.	33	ug/kg	100		89-109		
Benzo(a)anthracene	< 170	170.	33	ug/kg	97		86-113		
Benzo(a)pyrene	< 170	170.	33	ug/kg	74		63-138		
Benzo(b)fluoranthene	< 170	170.	33	ug/kg	78		61-133		
Benzo(g,h,i)perylene	< 170	170.	33	ug/kg	77		63-130		
Chrysene	< 170	170.	33	ug/kg	105		84-117		
Fluorene	< 170	170.	33	ug/kg	96		84-113		
Naphthalene	< 170	170.	33	ug/kg	95		83-112		

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 07/16/10 at 10:09 AM

Group Number: 1192441

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Phenanthrene	< 170	170.	33	ug/kg	99		86-109		
Pyrene	< 170	170.	33	ug/kg	101		86-122		

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank MDL**</u>	<u>Blank LOQ</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: 10124SLI026	Sample number(s): 5966974-5966981								
Anthracene	N.D.	33.	170	ug/kg	100		89-109		
Benzo(a)anthracene	N.D.	33.	170	ug/kg	96		86-113		
Benzo(a)pyrene	N.D.	33.	170	ug/kg	71		63-138		
Benzo(b)fluoranthene	N.D.	33.	170	ug/kg	68		61-133		
Benzo(g,h,i)perylene	N.D.	33.	170	ug/kg	71		63-130		
Chrysene	N.D.	33.	170	ug/kg	97		84-117		
Fluorene	N.D.	33.	170	ug/kg	95		84-113		
Naphthalene	N.D.	33.	170	ug/kg	94		83-112		
Phenanthrene	N.D.	33.	170	ug/kg	98		86-109		
Pyrene	N.D.	33.	170	ug/kg	105		86-122		
Batch number: 101266150002A	Sample number(s): 5966974-5966983								
Lead	N.D.	0.0300	0.200	mg/kg	110		80-120		
Batch number: 10124820005B	Sample number(s): 5966974-5966983								
Moisture					100		99-101		

Sample Matrix Quality Control

 Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS %REC</u>	<u>MSD %REC</u>	<u>MS/MSD Limits</u>	<u>RPD</u>	<u>RPD MAX</u>	<u>BKG Conc</u>	<u>DUP Conc</u>	<u>DUP RPD</u>	<u>Dup RPD Max</u>
Batch number: X101231AA	Sample number(s): 5966974,5966977,5966980-5966983 UNSPK: P966079								
Benzene	112		55-143						
1,2-Dibromoethane	116		54-129						
1,2-Dichloroethane	120		53-143						
Ethylbenzene	111		44-141						
Isopropylbenzene	111		38-144						
Methyl Tertiary Butyl Ether	126		55-129						
Toluene	110		50-146						
1,2,4-Trimethylbenzene	115		37-149						
1,3,5-Trimethylbenzene	115		38-150						
Xylene (Total)	111		44-136						
Batch number: 10124SLJ026	Sample number(s): 5966982-5966983 UNSPK: P966671								
Anthracene	96	253*	76-111	87*	30				
Benzo(a)anthracene	76*	356*	78-111	113*	30				
Benzo(a)pyrene	54*	213*	57-129	101*	30				
Benzo(b)fluoranthene	46*	226*	53-131	110*	30				

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 07/16/10 at 10:09 AM

Group Number: 1192441

Sample Matrix Quality Control

 Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS</u> <u>%REC</u>	<u>MSD</u> <u>%REC</u>	<u>MS/MSD</u> <u>Limits</u>	<u>RPD</u> <u>RPD</u>	<u>RPD</u> <u>MAX</u>	<u>BKG</u> <u>Conc</u>	<u>DUP</u> <u>Conc</u>	<u>DUP</u> <u>RPD</u>	<u>Dup RPD</u> <u>Max</u>
Benzo(g,h,i)perylene	66	150*	60-123	68*	30				
Chrysene	77	337*	76-114	109*	30				
Fluorene	95	128*	75-111	30	30				
Naphthalene	98	97	33-140	1	30				
Phenanthrene	93	503*	69-115	129*	30				
Pyrene	76	541*	76-124	131*	30				
Batch number: 10124SLI026 Sample number(s): 5966974-5966981 UNSPK: 5966974									
Anthracene	100	98	76-111	2	30				
Benzo(a)anthracene	96	93	78-111	3	30				
Benzo(a)pyrene	70	69	57-129	1	30				
Benzo(b)fluoranthene	64	70	53-131	8	30				
Benzo(g,h,i)perylene	73	71	60-123	2	30				
Chrysene	97	94	76-114	2	30				
Fluorene	95	93	75-111	2	30				
Naphthalene	96	94	33-140	2	30				
Phenanthrene	96	94	69-115	2	30				
Pyrene	109	108	76-124	1	30				
Batch number: 101266150002A Sample number(s): 5966974-5966983 UNSPK: P972031 BKG: P972031									
Lead	439 (2)	-14 (2)	75-125	20	20	61.7	62.1	1	20
Batch number: 10124820005B Sample number(s): 5966974-5966983 BKG: P966988									
Moisture						23.2	22.5	3	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

 Analysis Name: UST - Soils by 8260B
 Batch number: R101241AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
5966975	80	86	103	90
5966976	69*	73	69*	75
5966978	73	75	71	77
5966979	69*	73	68*	71
Blank	85	88	86	87
LCS	87	88	89	89
LCS D	86	90	86	86
Limits:	71-114	70-109	70-123	70-111

 Analysis Name: UST - Soils by 8260B
 Batch number: X101231AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
5966974	102	109	90	93
5966977	104	108	96	84

*- Outside of specification

**- This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 07/16/10 at 10:09 AM

Group Number: 1192441

Surrogate Quality Control

5966980	115*	122*	118	67*
5966981	102	104	99	98
5966982	100	105	100	94
5966983	104	108	99	94
Blank	101	100	92	99
LCS	102	105	100	102
LCSD	101	105	99	100
MS	101	110*	100	99
<hr/>				
Limits:	71-114	70-109	70-123	70-111

 Analysis Name: PAH 8270 (microwave)
 Batch number: 10124SLI026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
5966974	100	106	100
5966975	109	99	98
5966976	95	99	91
5966977	97	103	97
5966978	76	79	78
5966979	88	91	87
5966980	95	91	87
5966981	91	98	93
Blank	98	103	97
LCS	97	101	94
MS	95	102	97
MSD	93	101	95
<hr/>			
Limits:	55-121	74-110	57-112

 Analysis Name: PAH 8270 (microwave)
 Batch number: 10124SLJ026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
5966982	89	94	84
5966983	92	99	84
Blank	97	101	90
LCS	96	102	89
MS	97	101	90
MSD	93	97	83
<hr/>			
Limits:	55-121	74-110	57-112

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 10132 Group# 1192441 Sample # 5966974-83

COC # 193381

Please print. Instructions on reverse side correspond with circled numbers.

1 Client: SUN - AQUATERRA Acct. #: _____
 Project Name/#: PHILA REF AOT-3 PWSID #: _____
 Project Manager: T. DOERR P.O.#: _____
 Sampler: S. SYKES Quote #: _____
 Name of state where samples were collected: PA

5 Analyses Requested

Matrix	4		5 Analyses Requested										
	Potable	Check if Applicable	Preservation Codes										
	<input type="checkbox"/>	<input type="checkbox"/>	Soil	Water	Other	Total # of Containers	Benzene, Toluene, Ethylbenzene, mXylene, pXylene, Toluene, Ethylbenzene, mXylene, Naphthalene	EDB, 1,2 Dichloroethane	1,2,4 + 1,3,5 TMBs	6270C - PMS	Anthracene, Benzo(a)anthracene	Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene	Fluorene, Naphthalene, Phenanthrene, Pyrene
			X	X		X	X	X	X	X			

For Lab Use Only
 FSC: _____
 SCR#: 89687

Preservation Codes
 H=HCl T=Thiosulfate
 N=HNO₃ B=NaOH
 S=H₂SO₄ O=Other

Lead required per T.D. 4/30/10
 Naph. under 8270 only per T.D. 4/30/10

6 Temperature of samples upon receipt (if requested)

2 Sample Identification

Sample Identification	Date Collected	Time Collected	3 Grab	3 Composite
S-291-1-2'	4/26/10	1120	X	X
BH-10-01-1-2'	4/26/10	1300	X	X
BH-10-02-1-2'	4/26/10	1400	X	X
BH-10-03-1-2'	4/27/10	830	X	X
S-290-1-2'	4/27/10	915	X	X
S-286-1-2'	4/27/10	1145	X	X
S-285-1-2'	4/27/10	1330	X	X
S-282-1-2'	4/27/10	1500	X	X
S-280-1-2'	4/28/10	945	X	X
S-312-1-2'	4/28/10	1300	X	X

4 Matrix

Soil	Water	Other	Total # of Containers	Benzene, Toluene, Ethylbenzene, mXylene, pXylene, Toluene, Ethylbenzene, mXylene, Naphthalene	EDB, 1,2 Dichloroethane	1,2,4 + 1,3,5 TMBs	6270C - PMS	Anthracene, Benzo(a)anthracene	Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene	Fluorene, Naphthalene, Phenanthrene, Pyrene
X	X		X	X	X	X	X			
X	X		X	X	X	X	X			
X	X		X	X	X	X	X			
X	X		X	X	X	X	X			
X	X		X	X	X	X	X			
X	X		X	X	X	X	X			
X	X		X	X	X	X	X			
X	X		X	X	X	X	X			
X	X		X	X	X	X	X			
X	X		X	X	X	X	X			

Remarks: See attached sheet for list of analyses for all samples

Cooler temp: 1.0 - 1.2°C

7 Turnaround Time Requested (TAT) (please circle): Normal Rush
 (Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
 Date results are needed: _____
 Rush results requested by (please circle): Phone Fax E-mail
 Phone #: _____ Fax #: _____
 E-mail address: _____

9

Relinquished by:	Date	Time	Received by:	Date	Time
<u>Bottle Storage</u>			<u>J. Lyddy</u>	4/23	7:00
<u>J. Lyddy</u>	4/23	9:35			
<u>J. Lyddy / AOT</u>	4/24	06:30	<u>Fridge</u>	4/24	06:30
<u>J. Lyddy</u>	4/29	10:30	<u>J. Lyddy</u>	4/29	10:30
<u>J. Lyddy</u>	4/29	15:20	<u>J. Lyddy</u>	4/29/10	15:20

8 Data Package Options (please circle if required)

Type I (validation/NJ Reg)	TX TRRP-13	SDG Complete? Yes No
Type II (Tier II)	MA MCP CT RCP	
Type III (Reduced NJ)	Site-specific QC (MS/MSD/Dup)? Yes No	
Type IV (CLP SOW)	(If yes, indicate QC sample and submit triplicate volume.)	
Type VI (Raw Data Only)	Internal COC Required? Yes / No	

Table 1 (continued)
Constituents of Concern for Soil
AOI 7 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

METALS	CAS No.
Lead (total)	7439-92-1

VOLATILE ORGANIC COMPOUNDS	CAS No.
1,2-dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene dibromide	106-93-4
Methyl tertiary butyl ether	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo (g,h,i) perylene	191-24-2
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Notes:

1. Constituents are from Pennsylvania Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E (pgs. 29-30) of PADEP Document, *Closure Requirements for Underground Storage Tank Systems*, effective April 1, 1998 and the March 18, 2008 revised PADEP Petroleum Short List.

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	R	BMQL	B
N.D.	N	MPN	M
TNTC	T	CP Units	C
IU	I	NTU	N
umhos/cm	U	ng	N
C	C	F	F
meq	M	lb.	L
g	G	kg	K
ug	U	mg	M
ml	M	l	L
m3	M	ul	U
<	Less than - T		
>	Greater than		
J	Judgmental		
ppm	Parts per million - O		
ppb	Parts per billion		
Dry weight basis	Reported on a dry weight basis		

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers		Inorganic Qualifiers	
A	TIC	B	V
B	A	E	E
C	GC/MS	M	D
D	C	N	S
E	C	S	M
N	(TIC)	U	C
P	C	W	D
U	C	*	C
X,Y,Z	D	+	C

A... NELAC...
M...
T... C... U... W... T...

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REVISED

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 16, 2010

Project: SUN: Philadelphia Refinery AOI-3

Submittal Date: 05/14/2010
Group Number: 1194656
PO Number: PHILADELPHIA
State of Sample Origin: PAClient Sample DescriptionBH-10-04_1-2' Grab Soil
S-284_1-2' Grab SoilLancaster Labs (LLI) #5980695
5980696

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

REVISED

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,



Adrienne Kuhl
Specialist Group Leader



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Sample Description: BH-10-04_1-2' Grab Soil
 Philadelphia Refinery AOI-3
 COC: 221504 BH-10-04_1-2'

LLI Sample # SW 5980695
 LLI Group # 1194656
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 05/13/2010 10:30 by SS

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/14/2010 15:00

Reported: 07/16/2010 10:08

Discard: 09/15/2010

B1004

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10950	Benzene	71-43-2	< 5	5	0.5	0.87
10950	1,2-Dibromoethane	106-93-4	< 5	5	1	0.87
10950	1,2-Dichloroethane	107-06-2	< 5	5	1	0.87
10950	Ethylbenzene	100-41-4	< 5	5	1	0.87
10950	Isopropylbenzene	98-82-8	< 5	5	1	0.87
10950	Methyl Tertiary Butyl Ether	1634-04-4	< 5	5	0.5	0.87
10950	Toluene	108-88-3	< 5	5	1	0.87
10950	1,2,4-Trimethylbenzene	95-63-6	< 5	5	1	0.87
10950	1,3,5-Trimethylbenzene	108-67-8	< 5	5	1	0.87
10950	Xylene (Total)	1330-20-7	< 5	5	1	0.87
GC/MS Semivolatiles SW-846 8270C						
10724	Anthracene	120-12-7	< 200	200	40	1
10724	Benzo(a)anthracene	56-55-3	< 200	200	40	1
10724	Benzo(a)pyrene	50-32-8	< 200	200	40	1
10724	Benzo(b)fluoranthene	205-99-2	< 200	200	40	1
10724	Benzo(g,h,i)perylene	191-24-2	< 200	200	40	1
10724	Chrysene	218-01-9	< 200	200	40	1
10724	Fluorene	86-73-7	< 200	200	40	1
10724	Naphthalene	91-20-3	< 200	200	40	1
10724	Phenanthrene	85-01-8	< 200	200	40	1
10724	Pyrene	129-00-0	< 200	200	40	1
Metals SW-846 6020						
06135	Lead	7439-92-1	32.2	0.235	0.0352	2
Wet Chemistry SM20 2540 G						
00111	Moisture	n.a.	17.2	0.50	0.50	1
"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201013421137	05/13/2010 10:30	Client Supplied	1

*=This limit was used in the evaluation of the final result

Sample Description: BH-10-04_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 221504 BH-10-04_1-2'

LLI Sample # SW 5980695
LLI Group # 1194656
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 05/13/2010 10:30 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 05/14/2010 15:00

West Chester PA 19381

Reported: 07/16/2010 10:08

Discard: 09/15/2010

B1004

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201013421137	05/13/2010	10:30	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201013421137	05/13/2010	10:30	Client Supplied	1
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260B	1	X101381AA	05/18/2010	16:38	Emily R Styer	0.87
10724	PAH 8270 (microwave)	SW-846 8270C	1	10135SLC026	05/21/2010	01:13	Gregory J Drahovsky	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10135SLC026	05/17/2010	10:20	Doreen K Robles	1
06135	Lead	SW-846 6020	1	101386150002A	05/21/2010	13:26	Choon Y Tian	2
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101386150002	05/18/2010	21:08	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10137820006A	05/17/2010	15:16	Scott W Freisher	1



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Sample Description: S-284_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 221504 S-284_1-2'

LLI Sample # SW 5980696
LLI Group # 1194656
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 05/13/2010 15:00 by SS

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/14/2010 15:00

Reported: 07/16/2010 10:08

Discard: 09/15/2010

S284-

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10950	Benzene	71-43-2	< 4	4	0.4	0.76
10950	1,2-Dibromoethane	106-93-4	< 4	4	0.9	0.76
10950	1,2-Dichloroethane	107-06-2	< 4	4	0.9	0.76
10950	Ethylbenzene	100-41-4	< 4	4	0.9	0.76
10950	Isopropylbenzene	98-82-8	< 4	4	0.9	0.76
10950	Methyl Tertiary Butyl Ether	1634-04-4	< 4	4	0.4	0.76
10950	Toluene	108-88-3	< 4	4	0.9	0.76
10950	1,2,4-Trimethylbenzene	95-63-6	< 4	4	0.9	0.76
10950	1,3,5-Trimethylbenzene	108-67-8	< 4	4	0.9	0.76
10950	Xylene (Total)	1330-20-7	< 4	4	0.9	0.76
GC/MS Semivolatiles SW-846 8270C						
10724	Anthracene	120-12-7	< 190	190	38	1
10724	Benzo(a)anthracene	56-55-3	< 190	190	38	1
10724	Benzo(a)pyrene	50-32-8	< 190	190	38	1
10724	Benzo(b)fluoranthene	205-99-2	< 190	190	38	1
10724	Benzo(g,h,i)perylene	191-24-2	< 190	190	38	1
10724	Chrysene	218-01-9	< 190	190	38	1
10724	Fluorene	86-73-7	< 190	190	38	1
10724	Naphthalene	91-20-3	< 190	190	38	1
10724	Phenanthrene	85-01-8	< 190	190	38	1
10724	Pyrene	129-00-0	< 190	190	38	1
Metals SW-846 6020						
06135	Lead	7439-92-1	14.3	0.223	0.0334	2
Wet Chemistry SM20 2540 G						
00111	Moisture	n.a.	11.9	0.50	0.50	1
"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201013421137	05/13/2010 15:00	Client Supplied	1

*=This limit was used in the evaluation of the final result

Sample Description: S-284_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 221504 S-284_1-2'

LLI Sample # SW 5980696
LLI Group # 1194656
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 05/13/2010 15:00 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 05/14/2010 15:00

West Chester PA 19381

Reported: 07/16/2010 10:08

Discard: 09/15/2010

S284-

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201013421137	05/13/2010	15:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201013421137	05/13/2010	15:00	Client Supplied	1
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260B	1	X101381AA	05/18/2010	17:01	Emily R Styer	0.76
10724	PAH 8270 (microwave)	SW-846 8270C	1	10135SLC026	05/21/2010	01:37	Gregory J Drahovsky	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10135SLC026	05/17/2010	10:20	Doreen K Robles	1
06135	Lead	SW-846 6020	1	101386150002A	05/21/2010	13:28	Choon Y Tian	2
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101386150002	05/18/2010	21:08	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10137820006A	05/17/2010	15:16	Scott W Freisher	1

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 07/16/10 at 10:08 AM

Group Number: 1194656

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: X101381AA	Sample number(s): 5980695-5980696								
Benzene	< 5	5.	0.5	ug/kg	96		80-120		
1,2-Dibromoethane	< 5	5.	1	ug/kg	97		80-120		
1,2-Dichloroethane	< 5	5.	1	ug/kg	100		71-129		
Ethylbenzene	< 5	5.	1	ug/kg	102		80-120		
Isopropylbenzene	< 5	5.	1	ug/kg	103		76-120		
Methyl Tertiary Butyl Ether	< 5	5.	0.5	ug/kg	100		74-121		
Toluene	< 5	5.	1	ug/kg	99		80-120		
1,2,4-Trimethylbenzene	< 5	5.	1	ug/kg	102		79-120		
1,3,5-Trimethylbenzene	< 5	5.	1	ug/kg	103		78-120		
Xylene (Total)	< 5	5.	1	ug/kg	102		80-120		
Batch number: 10135SLC026	Sample number(s): 5980695-5980696								
Anthracene	< 170	170.	33	ug/kg	104		89-109		
Benzo(a)anthracene	< 170	170.	33	ug/kg	97		86-113		
Benzo(a)pyrene	< 170	170.	33	ug/kg	93		63-138		
Benzo(b)fluoranthene	< 170	170.	33	ug/kg	88		61-133		
Benzo(g,h,i)perylene	< 170	170.	33	ug/kg	94		63-130		
Chrysene	< 170	170.	33	ug/kg	100		84-117		
Fluorene	< 170	170.	33	ug/kg	97		84-113		
Naphthalene	< 170	170.	33	ug/kg	100		83-112		
Phenanthrene	< 170	170.	33	ug/kg	102		86-109		
Pyrene	< 170	170.	33	ug/kg	105		86-122		
Batch number: 101386150002A	Sample number(s): 5980695-5980696								
Lead	< 0.200	0.200	0.0300	mg/kg	102		80-120		
Batch number: 10137820006A	Sample number(s): 5980695-5980696								
Moisture					100		99-101		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS %REC</u>	<u>MSD %REC</u>	<u>MS/MSD Limits</u>	<u>RPD</u>	<u>RPD MAX</u>	<u>BKG Conc</u>	<u>DUP Conc</u>	<u>DUP RPD</u>	<u>Dup RPD Max</u>
Batch number: X101381AA	Sample number(s): 5980695-5980696 UNSPK: P980934								
Benzene	109	106	55-143	1	30				
1,2-Dibromoethane	115	115	54-129	3	30				
1,2-Dichloroethane	119	117	53-143	1	30				
Ethylbenzene	108	106	44-141	0	30				
Isopropylbenzene	105	102	38-144	1	30				

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 07/16/10 at 10:08 AM

Group Number: 1194656

Sample Matrix Quality Control

 Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS</u> <u>%REC</u>	<u>MSD</u> <u>%REC</u>	<u>MS/MSD</u> <u>Limits</u>	<u>RPD</u> <u>RPD</u>	<u>RPD</u> <u>MAX</u>	<u>BKG</u> <u>Conc</u>	<u>DUP</u> <u>Conc</u>	<u>DUP</u> <u>RPD</u>	<u>Dup RPD</u> <u>Max</u>
Methyl Tertiary Butyl Ether	124	124	55-129	3	30				
Toluene	112	113	50-146	3	30				
1,2,4-Trimethylbenzene	112	117	37-149	7	30				
1,3,5-Trimethylbenzene	116	125	38-150	10	30				
Xylene (Total)	106	103	44-136	0	30				
Batch number: 10135SLC026 Sample number(s): 5980695-5980696 UNSPK: P979368									
Anthracene	125*	133*	76-111	6	30				
Benzo(a)anthracene	91	93	78-111	1	30				
Benzo(a)pyrene	147*	141*	57-129	4	30				
Benzo(b)fluoranthene	80	83	53-131	2	30				
Benzo(g,h,i)perylene	126*	118	60-123	6	30				
Chrysene	124*	90	76-114	15	30				
Fluorene	117*	121*	75-111	3	30				
Naphthalene	88	82	33-140	3	30				
Phenanthrene	104	95	69-115	5	30				
Pyrene	155*	133*	76-124	7	30				
Batch number: 101386150002A Sample number(s): 5980695-5980696 UNSPK: P981157 BKG: P981157									
Lead	1237	480 (2)	75-125	24*	20	69.8	76.5	9	20
(2)									
Batch number: 10137820006A Sample number(s): 5980695-5980696 BKG: P980697									
Moisture						18.7	18.9	2	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

 Analysis Name: TCL(4.3)by 8260(soil)
 Batch number: X101381AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
5980695	102	107	92	94
5980696	100	106	94	96
Blank	99	99	95	95
LCS	98	103	102	98
MS	102	109	104	90
MSD	103	108	108	88
Limits:	71-114	70-109	70-123	70-111

Analysis Name: PAH 8270 (microwave)

Batch number: 10135SLC026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
5980695	92	107	98
5980696	89	107	96
Blank	98	100	94

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech.
Reported: 07/16/10 at 10:08 AM

Group Number: 1194656

Surrogate Quality Control

LCS	101	103	97
MS	93	97	92
MSD	85	93	82
Limits:	55-121	74-110	57-112

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Analysis Request / Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 10132 Group # 1194656 Sample # 5980695-96

COC # 221504

Temp 4.9°C
For Lab Use Only

Please print. Instructions on reverse side correspond with circled numbers.

1 Client: SUN-AQUA TERRA Acct. #: _____
 Project Name: PHILADELPHIA REFINERY ADI-3PWSID #:
 Project Manager: T. DOERR P.O.#: _____
 Sampler: S. SYKES Quote #: PA
 Name of state where samples were collected: _____

4 Matrix: Potable NPDES Other
 Soil Water Composite

5 Analyses Requested

Preservation Codes	Lead (Total)	1,2-dichlorobenzene	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Benzene, Cumene, Ethylbenzene	EDG, mTBE, Toluene	Xylenes	Anthracene, Benz(a)h	Anthracene, Benz(a)h	Acetone, Benz(a)h	Perylene, Benz(a)h	Phenanthrene, Fluorene	Naphthalene, Phenanthrene
	X	X	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X	X	X

6 Preservation Codes
 H=HCl T=Thiosulfate
 N=HNO₃ B=NaOH
 S=H₂SO₄ O=Other

Remarks: * See attached list for analyses

3

Sample Identification	Date Collected	Time Collected	Total # of Containers
BH-10-04-1-21	5/13/10	1030	4
S-284-1-21	5/13/10	1500	4

7 Turnaround Time Requested (TAT) (please circle): Normal Rush
 (Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
 Date results are needed: _____
 Rush results requested by (please circle): Phone Fax E-mail
 Phone #: _____ Fax #: _____
 E-mail address: _____

8 Data Package Options (please circle if required)
 TX TRRP-13 Yes No
 MA MCP CT RCP Yes No
 Site-specific QC (MS/MSD/Dup)? Yes No
 (If yes, indicate QC serials and submit triplicate volume.)
 Internal COC Required? Yes / No _____

9

Relinquished by:	Date	Time	Received by:	Date	Time
<u>[Signature]</u>	5/13/10	1700	Fr.idge	5/13/10	1700
<u>[Signature]</u>	5/14/10	1042	J. DeFever	5/14/10	1042
<u>[Signature]</u>	5/14/10	1500	J. DeFever	5/14/10	1500
<u>[Signature]</u>					

10132/1194656/598095-96

Table 1 (continued)
Constituents of Concern for Soil
AOI 7 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

METALS	CAS No.
Lead (total)	7439-92-1

VOLATILE ORGANIC COMPOUNDS	CAS No.
1,2-dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene dibromide	106-93-4
Methyl tertiary butyl ether	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo (g,h,i) perylene	191-24-2
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Notes:

1. Constituents are from Pennsylvania Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E (pgs. 29-30) of PADEP Document, *Closure Requirements for Underground Storage Tank Systems*, effective April 1, 1998 and the March 18, 2008 revised PADEP Petroleum Short List.

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	R	BMQL	B
N.D.	N	MPN	M
TNTC	T	CP Units	C
IU	I	NTU	N
umhos/cm	U	ng	ng
C	C	F	F
meq	meq	lb.	lb.
g	g	kg	kg
ug	ug	mg	mg
ml	ml	l	l
m3	m ³	ul	ul
<	<		
>	>		
J	J		
ppm	ppm		
ppb	ppb		
Dry weight basis	Dry weight basis		

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

Inorganic Qualifiers

A	TIC	B	V
B	A	E	E
C	GC/MS	M	D
D	C	N	S
E	C	S	M
N	(TIC)	U	C
P	C	W	
U	C	*	D
X,Y,Z	D	+	C

A NELAC...
M...
T...
U...
I...
W...
T...

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REVISED

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 16, 2010

Project: SUN: Philadelphia Refinery AOI-3

Submittal Date: 06/22/2010
Group Number: 1200002
PO Number: PHILADELPHIA REFINERY
State of Sample Origin: PAClient Sample Description

S-288_1-2' Grab Soil

Lancaster Labs (LLI) #

6014020

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Megan Breen
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward

REVISED

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,



Adrienne Kuhl
Specialist Group Leader



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Page 1 of 2

REVISED

Sample Description: S-288_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 232892 S-288_1-2'

LLI Sample # SW 6014020
LLI Group # 1200002
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 06/17/2010 13:00 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 06/22/2010 16:40

West Chester PA 19381

Reported: 07/16/2010 09:41

Discard: 09/15/2010

AOI3-

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846 8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene	71-43-2	8	5	0.5	0.88
10950	1,2-Dibromoethane	106-93-4	< 5	5	1	0.88
10950	1,2-Dichloroethane	107-06-2	< 5	5	1	0.88
10950	Ethylbenzene	100-41-4	< 5	5	1	0.88
10950	Isopropylbenzene	98-82-8	< 5	5	1	0.88
10950	Methyl Tertiary Butyl Ether	1634-04-4	< 5	5	0.5	0.88
10950	Toluene	108-88-3	9	5	1	0.88
10950	1,2,4-Trimethylbenzene	95-63-6	< 5	5	1	0.88
10950	1,3,5-Trimethylbenzene	108-67-8	< 5	5	1	0.88
10950	Xylene (Total)	1330-20-7	5	5	1	0.88

The GC/MS volatile internal standard peak areas were outside the QC limits for both the initial analysis and the re-analysis. The values reported here are from the initial analysis of the sample.

GC/MS	Semivolatiles	SW-846 8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene	120-12-7	3,500	180	36	1
10724	Benzo(a)anthracene	56-55-3	7,600	910	180	5
10724	Benzo(a)pyrene	50-32-8	7,200	910	180	5
10724	Benzo(b)fluoranthene	205-99-2	8,600	910	180	5
10724	Benzo(g,h,i)perylene	191-24-2	5,000	910	180	5
10724	Chrysene	218-01-9	7,600	910	180	5
10724	Fluorene	86-73-7	1,600	180	36	1
10724	Naphthalene	91-20-3	2,900	180	36	1
10724	Phenanthrene	85-01-8	16,000	910	180	5
10724	Pyrene	129-00-0	13,000	910	180	5

The recovery of phenanthrene was above QC limits in the LCS. This sample was re-extracted outside of the method required holding time, and acceptable QC and comparable data were observed. The data reported here is from the initial extraction of the sample.

Metals	SW-846 6020	mg/kg	mg/kg	mg/kg		
06135	Lead	7439-92-1	223	1.08	0.0539	10

Wet Chemistry	SM20 2540 G	%	%	%		
00111	Moisture	n.a.	8.1	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

*=This limit was used in the evaluation of the final result



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Page 2 of 2

REVISED

Sample Description: S-288_1-2' Grab Soil
Philadelphia Refinery AOI-3
COC: 232892 S-288_1-2'

LLI Sample # SW 6014020
LLI Group # 1200002
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 06/17/2010 13:00 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 06/22/2010 16:40

West Chester PA 19381

Reported: 07/16/2010 09:41

Discard: 09/15/2010

AOI3-

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201017421508	06/17/2010 13:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201017421508	06/17/2010 13:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201017421508	06/17/2010 13:00	Client Supplied	1
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260B	1	X101771AA	06/26/2010 09:23	Stephanie A Selis	0.88
10724	PAH 8270 (microwave)	SW-846 8270C	1	10174SLC026	06/30/2010 15:22	Ryan P Byrne	1
10724	PAH 8270 (microwave)	SW-846 8270C	1	10174SLC026	06/30/2010 22:57	Ryan P Byrne	5
10814	BNA Soil Microwave PAH	SW-846 3546	1	10174SLC026	06/23/2010 23:30	Patricia L Foreman	1
06135	Lead	SW-846 6020	1	101746150001A	06/28/2010 04:26	Choon Y Tian	10
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101746150001	06/23/2010 20:26	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10175820007B	06/24/2010 17:38	Scott W Freisher	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 07/16/10 at 09:41 AM

Group Number: 1200002

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: X101771AA	Sample number(s): 6014020								
Benzene	< 5	5.	0.5	ug/kg	95	95	80-120	0	30
1,2-Dibromoethane	< 5	5.	1	ug/kg	102	101	80-120	1	30
1,2-Dichloroethane	< 5	5.	1	ug/kg	101	98	71-129	2	30
Ethylbenzene	< 5	5.	1	ug/kg	97	96	80-120	1	30
Isopropylbenzene	< 5	5.	1	ug/kg	103	102	76-120	1	30
Methyl Tertiary Butyl Ether	< 5	5.	0.5	ug/kg	100	101	74-121	1	30
Toluene	< 5	5.	1	ug/kg	96	96	80-120	0	30
1,2,4-Trimethylbenzene	< 5	5.	1	ug/kg	95	94	79-120	0	30
1,3,5-Trimethylbenzene	< 5	5.	1	ug/kg	96	96	78-120	0	30
Xylene (Total)	< 5	5.	1	ug/kg	97	97	80-120	0	30
Batch number: 10174SLC026	Sample number(s): 6014020								
Anthracene	< 170	170.	33	ug/kg	105		89-109		
Benzo(a)anthracene	< 170	170.	33	ug/kg	105		86-113		
Benzo(a)pyrene	< 170	170.	33	ug/kg	98		63-138		
Benzo(b)fluoranthene	< 170	170.	33	ug/kg	100		61-133		
Benzo(g,h,i)perylene	< 170	170.	33	ug/kg	108		63-130		
Chrysene	< 170	170.	33	ug/kg	110		84-117		
Fluorene	< 170	170.	33	ug/kg	103		84-113		
Naphthalene	< 170	170.	33	ug/kg	101		83-112		
Phenanthrene	< 170	170.	33	ug/kg	110*		86-109		
Pyrene	< 170	170.	33	ug/kg	105		86-122		
Batch number: 101746150001A	Sample number(s): 6014020								
Lead	< 0.200	0.200	0.0100	mg/kg	114		80-120		
Batch number: 10175820007B	Sample number(s): 6014020								
Moisture					100		99-101		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS %REC</u>	<u>MSD %REC</u>	<u>MS/MSD Limits</u>	<u>RPD</u>	<u>RPD MAX</u>	<u>BKG Conc</u>	<u>DUP Conc</u>	<u>DUP RPD</u>	<u>Dup RPD Max</u>
Batch number: X101771AA	Sample number(s): 6014020 UNSPK: P015610								
Benzene	107		55-143						
1,2-Dibromoethane	111		54-129						
1,2-Dichloroethane	104		53-143						
Ethylbenzene	110		44-141						
Isopropylbenzene	110		38-144						

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 07/16/10 at 09:41 AM

Group Number: 1200002

Sample Matrix Quality Control

 Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS</u> <u>%REC</u>	<u>MSD</u> <u>%REC</u>	<u>MS/MSD</u> <u>Limits</u>	<u>RPD</u>	<u>RPD</u> <u>MAX</u>	<u>BKG</u> <u>Conc</u>	<u>DUP</u> <u>Conc</u>	<u>DUP</u> <u>RPD</u>	<u>Dup RPD</u> <u>Max</u>
Methyl Tertiary Butyl Ether	111		55-129						
Toluene	109		50-146						
1,2,4-Trimethylbenzene	108		37-149						
1,3,5-Trimethylbenzene	111		38-150						
Xylene (Total)	109		44-136						
Batch number: 10174SLC026 Sample number(s): 6014020 UNSPK: P013640									
Anthracene	96	93	76-111	3	30				
Benzo(a)anthracene	103	116*	78-111	9	30				
Benzo(a)pyrene	89	86	57-129	3	30				
Benzo(b)fluoranthene	99	84	53-131	12	30				
Benzo(g,h,i)perylene	93	87	60-123	6	30				
Chrysene	101	113	76-114	7	30				
Fluorene	95	91	75-111	4	30				
Naphthalene	88	84	33-140	5	30				
Phenanthrene	128*	96	69-115	20	30				
Pyrene	146*	130*	76-124	9	30				
Batch number: 101746150001A Sample number(s): 6014020 UNSPK: P009127 BKG: P009127									
Lead	113	93	75-125	11	20	2.39	2.38	1	20
Batch number: 10175820007B Sample number(s): 6014020 BKG: P014661									
Moisture						18.5	17.7	5	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

 Analysis Name: TCL(4.3)by 8260(soil)
 Batch number: X101771AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6014020	105	103	118	73
Blank	99	105	94	95
LCS	100	106	103	101
LCSD	99	106	101	100
MS	98	99	102	99
Limits:	71-114	70-109	70-123	70-111

 Analysis Name: PAH 8270 (microwave)
 Batch number: 10174SLC026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6014020	89	99	71
Blank	90	92	82
LCS	100	97	90
MS	94	93	86
MSD	90	94	90

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only
 Acct. # 10132 Group# 200002 Sample # 6014070

COC # 232892

Please print. Instructions on reverse side correspond with circled numbers. 1.1-1.5

1 Client: SUN-AQUATERRA Acct. #: _____
 Project Name/#: PH REP ADI-3 PWSID #: _____
 Project Manager: T. DOERR P.O.#: _____
 Sampler: S. SIKES Quote #: _____
 Name of state where samples were collected: PA

5 Analyses Requested

Matrix		Preservation Codes											
Soil	Water	Lead (total)	1,2 Dichloroethane	Ethylbenzene	1,2,4 Trinitrobenzene	Benzene, cumene	Toluene, Xylenes	Anthracene	Benzofluoranthene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Pyrene
		X	X	X	X	X	X	X	X	X	X	X	X

For Lab Use Only
 FSC: _____
 SCR#: _____
Preservation Codes
 H=HCl T=Thiosulfate
 N=HNO₃ B=NaOH
 S=H₂SO₄ O=Other

6 Temperature of samples upon receipt (if requested)

2

Sample Identification	Date Collected	Time Collected	3 Grab	Composite	Soil	Water	Other	Total # of Containers
<u>S-288-1-2'</u>	<u>6/17/10</u>	<u>1300</u>	<u>X</u>		<u>X</u>			<u>4</u>

4

Soil	Water	Other	Total # of Containers
<u>X</u>			<u>4</u>

Remarks
* See attached list per T. Doerr for analyses

7 Turnaround Time Requested (TAT) (please circle): Normal Rush
 (Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
 Date results are needed: _____
 Rush results requested by (please circle): Phone Fax E-mail
 Phone #: _____ Fax #: _____
 E-mail address: _____

Relinquished by: <u>[Signature]</u> / AGM	Date: <u>6/17/10</u>	Time: <u>1700</u>	Received by: <u>Fridge</u>	Date: <u>6/17/10</u>	Time: <u>1706</u>
Relinquished by: <u>[Signature]</u> / AGT	Date: <u>6/22/10</u>	Time: <u>1115</u>	Received by: <u>[Signature]</u>	Date: <u>6/22/10</u>	Time: <u>1152</u>
Relinquished by: <u>[Signature]</u> / Saddy	Date: <u>6/22/10</u>	Time: <u>1646</u>	Received by: _____	Date: _____	Time: _____
Relinquished by: _____	Date: _____	Time: _____	Received by: _____	Date: _____	Time: _____
Relinquished by: _____	Date: _____	Time: _____	Received by: <u>[Signature]</u>	Date: <u>6/22/10</u>	Time: <u>1640</u>

8 Data Package Options (please circle if required)

Type I (validation/NJ Reg)	TX TRRP-13	SDG Complete? Yes <u> </u> No <u> </u>
Type II (Tier II)	MA MCP <u> </u> CT RCP <u> </u>	
Type III (Reduced NJ)	Site-specific QC (MS/MSD/Dup)? Yes <u> </u> No <u> </u>	
Type IV (CLP SOW)	(if yes, indicate QC sample and submit triplicate volume.)	
Type VI (Raw Data Only)	Internal COC Required? Yes / No <u> </u>	

10132|1200002|6014020

**Table 1 (continued)
 Constituents of Concern for Soil
 AOI 7 Work Plan for Site Characterization
 Sunoco Philadelphia Refinery
 Philadelphia, Pennsylvania**

METALS	CAS No.
Lead (total)	7439-92-1

VOLATILE ORGANIC COMPOUNDS	CAS No.
1,2-dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene dibromide	106-93-4
Methyl tertiary butyl ether	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo (g,h,i) perylene	191-24-2
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Notes:

1. Constituents are from Pennsylvania Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E (pgs. 29-30) of PADEP Document, *Closure Requirements for Underground Storage Tank Systems*, effective April 1, 1998 and the March 18, 2008 revised PADEP Petroleum Short List.

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	R	BMQL	B
N.D.	N	MPN	M
TNTC	T	CP Units	C
IU	I	NTU	N
umhos/cm	U	ng	N
C	C	F	F
meq	M	lb.	L
g	G	kg	K
ug	U	mg	M
ml	M	l	L
m3	M	ul	U
<	Less than - T		
>	Greater than		
J	Judgmental		
ppm	Parts per million - O		
ppb	Parts per billion		
Dry weight basis	Reported on a dry weight basis		

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers		Inorganic Qualifiers	
A	TIC	B	V
B	A	E	E
C	GC/MS	M	D
D	C	N	S
E	C	S	M
N	(TIC)	U	C
P	C	W	D
U	C	*	C
X,Y,Z	D	+	C

Reported on a dry weight basis

Reported on a dry weight basis

Reported on a dry weight basis

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ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 27, 2010

Project: SUN: Philadelphia Refinery AOI-3

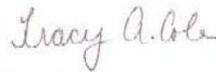
Submittal Date: 07/08/2010
Group Number: 1202221
PO Number: PHILADELPHIA REF
State of Sample Origin: PAClient Sample DescriptionS-280_070710 Grab Water
S-290_070710 Grab Water
S-291_070710 Grab Water
S-23_070710 Grab WaterLancaster Labs (LLI) #6027536
6027537
6027538
6027539

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Megan Breen
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,



Tracy A. Cole
Senior Specialist

Sample Description: S-280_070710 Grab Water
 Philadelphia Refinery AOI-3
 COC: 237714 S-280_070710

LLI Sample # WW 6027536
 LLI Group # 1202221
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/07/2010 13:30 by SS

SUN: Aquaterra Tech.

Submitted: 07/08/2010 16:50

PO Box 744

Reported: 07/27/2010 13:05

West Chester PA 19381

Discard: 08/11/2010

S-280

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B			ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	41,000	500	250	500
10943	1,2-Dichloroethane	107-06-2	< 50	50	25	50
10943	Ethylbenzene	100-41-4	< 50	50	25	50
10943	Isopropylbenzene	98-82-8	< 100	100	25	50
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 50	50	25	50
10943	Toluene	108-88-3	6,900	50	25	50
10943	1,2,4-Trimethylbenzene	95-63-6	< 100	100	25	50
10943	1,3,5-Trimethylbenzene	108-67-8	< 100	100	25	50
10943	Xylene (Total)	1330-20-7	< 50	50	25	50
GC/MS Semivolatiles SW-846 8270C			ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	7	5	1	1
07805	Naphthalene	91-20-3	6	5	1	1
07805	Phenanthrene	85-01-8	12	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011			ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.028	0.028	0.0094	1
Metals Dissolved SW-846 6020			mg/l	mg/l	mg/l	
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P101991AA	07/19/2010 00:05	Florida A Cimino	50
01163	GC/MS VOA Water Prep	SW-846 5030B	2	P101991AA	07/19/2010 00:34	Florida A Cimino	500
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P101991AA	07/19/2010 00:05	Florida A Cimino	50
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P101991AA	07/19/2010 00:34	Florida A Cimino	500
07805	PAHs by 8270	SW-846 8270C	1	10193WAE026	07/22/2010 03:49	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10193WAE026	07/12/2010 22:45	Karen L Beyer	1
07879	EDB in Wastewater	SW-846 8011	1	101910007A	07/14/2010 14:01	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101910007A	07/12/2010 09:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101936050003A	07/13/2010 20:38	David K Beck	1

*=This limit was used in the evaluation of the final result



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Sample Description: S-280_070710 Grab Water
Philadelphia Refinery AOI-3
COC: 237714 S-280_070710

LLI Sample # WW 6027536
LLI Group # 1202221
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/07/2010 13:30 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/08/2010 16:50

West Chester PA 19381

Reported: 07/27/2010 13:05

Discard: 08/11/2010

S-280

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101936050003	07/13/2010 09:27	Denise K Connors	1

*=This limit was used in the evaluation of the final result

Sample Description: S-290_070710 Grab Water
 Philadelphia Refinery AOI-3
 COC: 237714 S-290_070710

LLI Sample # WW 6027537
 LLI Group # 1202221
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/07/2010 12:20 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/08/2010 16:50

West Chester PA 19381

Reported: 07/27/2010 13:05

Discard: 08/11/2010

S-290

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	3	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	12	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	38	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	33	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	9	2	0.5	1
10943	Xylene (Total)	1330-20-7	99	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F101944AA	07/14/2010 02:59	Florida A Cimino	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F101944AA	07/14/2010 02:59	Florida A Cimino	1
07805	PAHs by 8270	SW-846 8270C	1	10193WAE026	07/22/2010 04:35	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10193WAE026	07/12/2010 22:45	Karen L Beyer	1
07879	EDB in Wastewater	SW-846 8011	1	101910007A	07/14/2010 14:31	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101910007A	07/12/2010 09:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101936050003A	07/13/2010 20:40	David K Beck	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101936050003	07/13/2010 09:27	Denise K Connors	1

*=This limit was used in the evaluation of the final result

Sample Description: S-291_070710 Grab Water
 Philadelphia Refinery AOI-3
 COC: 237714 S-291_070710

LLI Sample # WW 6027538
 LLI Group # 1202221
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/07/2010 09:40 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/08/2010 16:50

West Chester PA 19381

Reported: 07/27/2010 13:05

Discard: 08/11/2010

S-291

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B			ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 10	10	5	10
10943	1,2-Dichloroethane	107-06-2	< 10	10	5	10
10943	Ethylbenzene	100-41-4	< 10	10	5	10
10943	Isopropylbenzene	98-82-8	< 20	20	5	10
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 10	10	5	10
10943	Toluene	108-88-3	< 10	10	5	10
10943	1,2,4-Trimethylbenzene	95-63-6	< 20	20	5	10
10943	1,3,5-Trimethylbenzene	108-67-8	< 20	20	5	10
10943	Xylene (Total)	1330-20-7	< 10	10	5	10

The reporting limits for the GC/MS volatile compounds were raised, because insufficient sample volume remained to perform an undiluted analysis.

GC/MS Semivolatiles	SW-846 8270C	ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1
07805	Fluorene	86-73-7	< 5	5	1
07805	Naphthalene	91-20-3	25	5	1
07805	Phenanthrene	85-01-8	< 5	5	1
07805	Pyrene	129-00-0	< 5	5	1

Surrogate recoveries are outside of QC limits for the initial GC/MS semivolatiles analysis. The analysis was repeated outside of the required hold time and the surrogate recoveries are within the limits. The data reported is from the initial extraction of the sample.

GC Miscellaneous	SW-846 8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095

Metals Dissolved	SW-846 6020	mg/l	mg/l	mg/l	
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F101953AA	07/15/2010 00:19	Florida A Cimino	10
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F101953AA	07/15/2010 00:19	Florida A Cimino	10
07805	PAHs by 8270	SW-846 8270C	1	10193WAE026	07/22/2010 05:22	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10193WAE026	07/12/2010 22:45	Karen L Beyer	1

*=This limit was used in the evaluation of the final result

Sample Description: S-291_070710 Grab Water
 Philadelphia Refinery AOI-3
 COC: 237714 S-291_070710

LLI Sample # WW 6027538
LLI Group # 1202221
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/07/2010 09:40 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/08/2010 16:50

West Chester PA 19381

Reported: 07/27/2010 13:05

Discard: 08/11/2010

S-291

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution Factor
					Date	Time		
07879	EDB in Wastewater	SW-846 8011	1	101910007A	07/14/2010	15:01	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101910007A	07/12/2010	09:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101936050003A	07/13/2010	20:42	David K Beck	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101936050003	07/13/2010	09:27	Denise K Conners	1

Sample Description: S-23_070710 Grab Water
 Philadelphia Refinery AOI-3
 COC: 237714 S-23_070710

LLI Sample # WW 6027539
 LLI Group # 1202221
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/07/2010 11:00 by SS

SUN: Aquaterra Tech.

Submitted: 07/08/2010 16:50

PO Box 744

Reported: 07/27/2010 13:05

West Chester PA 19381

Discard: 08/11/2010

S-23-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B			ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	24	1	0.5	1
10943	Isopropylbenzene	98-82-8	2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	6	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	51	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	15	2	0.5	1
10943	Xylene (Total)	1330-20-7	57	1	0.5	1
GC/MS Semivolatiles SW-846 8270C			ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011			ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals Dissolved SW-846 6020			mg/l	mg/l	mg/l	
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F101944AA	07/14/2010 03:50	Florida A Cimino	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F101944AA	07/14/2010 03:50	Florida A Cimino	1
07805	PAHs by 8270	SW-846 8270C	1	10193WAE026	07/23/2010 02:29	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	10193WAE026	07/12/2010 22:45	Karen L Beyer	1
07879	EDB in Wastewater	SW-846 8011	1	101910007A	07/14/2010 15:31	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101910007A	07/12/2010 09:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101936050003A	07/13/2010 20:44	David K Beck	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101936050003	07/13/2010 09:27	Denise K Connors	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 07/27/10 at 01:05 PM

Group Number: 1202221

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: F101944AA									
Sample number(s): 6027537, 6027539									
Benzene	< 1	1.	0.5	ug/l	86	85	79-120	1	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	102	100	70-130	2	30
Ethylbenzene	< 1	1.	0.5	ug/l	84	84	79-120	1	30
Isopropylbenzene	< 2	2.	0.5	ug/l	86	84	77-120	2	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	86	83	76-120	4	30
Toluene	< 1	1.	0.5	ug/l	88	88	79-120	1	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	84	83	74-120	1	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	80	82	75-120	2	30
Xylene (Total)	< 1	1.	0.5	ug/l	86	86	80-120	0	30
Batch number: F101953AA									
Sample number(s): 6027538									
Benzene	< 1	1.	0.5	ug/l	87	89	79-120	2	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	107	106	70-130	1	30
Ethylbenzene	< 1	1.	0.5	ug/l	88	89	79-120	0	30
Isopropylbenzene	< 2	2.	0.5	ug/l	88	88	77-120	1	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	82	83	76-120	1	30
Toluene	< 1	1.	0.5	ug/l	95	94	79-120	1	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	84	83	74-120	1	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	79	79	75-120	1	30
Xylene (Total)	< 1	1.	0.5	ug/l	91	90	80-120	1	30
Batch number: P101991AA									
Sample number(s): 6027536									
Benzene	< 1	1.	0.5	ug/l	109	110	79-120	1	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	87	89	70-130	1	30
Ethylbenzene	< 1	1.	0.5	ug/l	84	85	79-120	1	30
Isopropylbenzene	< 2	2.	0.5	ug/l	80	83	77-120	4	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	107	109	76-120	2	30
Toluene	< 1	1.	0.5	ug/l	91	94	79-120	3	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	81	84	74-120	3	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	82	86	75-120	4	30
Xylene (Total)	< 1	1.	0.5	ug/l	85	87	80-120	2	30
Batch number: 10193WAE026									
Sample number(s): 6027536-6027539									
Chrysene	< 5	5.	1	ug/l	91	87	82-112	4	30
Fluorene	< 5	5.	1	ug/l	99	99	82-113	1	30
Naphthalene	< 5	5.	1	ug/l	89	86	77-107	4	30
Phenanthrene	< 5	5.	1	ug/l	94	91	83-112	3	30
Pyrene	< 5	5.	1	ug/l	93	91	80-115	2	30
Batch number: 101910007A									
Sample number(s): 6027536-6027539									
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	100	60-140	4	20
Batch number: 101936050003A									
Sample number(s): 6027536-6027539									
Lead	< 0.0010	0.0010	0.00005	mg/l	102		90-115		
			0						

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 07/27/10 at 01:05 PM

Group Number: 1202221

Sample Matrix Quality Control

 Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS</u> <u>%REC</u>	<u>MSD</u> <u>%REC</u>	<u>MS/MSD</u> <u>Limits</u>	<u>RPD</u> <u>RPD</u>	<u>BKG</u> <u>MAX</u>	<u>DUP</u> <u>Conc</u>	<u>DUP</u> <u>RPD</u>	<u>Dup RPD</u> <u>Max</u>
Batch number: F101944AA	Sample number(s): 6027537,6027539 UNSPK: P028410							
Benzene	93		80-126					
1,2-Dichloroethane	107		66-141					
Ethylbenzene	94		71-134					
Isopropylbenzene	96		75-128					
Methyl Tertiary Butyl Ether	88		72-126					
Toluene	99		80-125					
1,2,4-Trimethylbenzene	90		72-130					
1,3,5-Trimethylbenzene	84		72-131					
Xylene (Total)	96		79-125					
Batch number: F101953AA	Sample number(s): 6027538 UNSPK: P028907							
Benzene	95		80-126					
1,2-Dichloroethane	114		66-141					
Ethylbenzene	93		71-134					
Isopropylbenzene	91		75-128					
Methyl Tertiary Butyl Ether	85		72-126					
Toluene	100		80-125					
1,2,4-Trimethylbenzene	81		72-130					
1,3,5-Trimethylbenzene	78		72-131					
Xylene (Total)	96		79-125					
Batch number: P101991AA	Sample number(s): 6027536 UNSPK: P030840							
Benzene	114		80-126					
1,2-Dichloroethane	88		66-141					
Ethylbenzene	87		71-134					
Isopropylbenzene	84		75-128					
Methyl Tertiary Butyl Ether	109		72-126					
Toluene	96		80-125					
1,2,4-Trimethylbenzene	82		72-130					
1,3,5-Trimethylbenzene	84		72-131					
Xylene (Total)	88		79-125					
Batch number: 101910007A	Sample number(s): 6027536-6027539 UNSPK: P026501							
Ethylene dibromide	86	82	65-135	5	20			
Batch number: 101936050003A	Sample number(s): 6027536-6027539 UNSPK: P027958 BKG: P027958							
Lead	97	101	75-125	4	20	< 0.0010	< 0.0010	10 (1) 20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water

Batch number: F101944AA

Dibromofluoromethane

1,2-Dichloroethane-d4

Toluene-d8

4-Bromofluorobenzene

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 07/27/10 at 01:05 PM

Group Number: 1202221

Surrogate Quality Control

6027537	101	99	100	97
6027539	102	95	101	97
Blank	105	98	99	90
LCS	100	97	100	104
LCSD	103	99	99	104
MS	103	97	101	107

Limits: 80-116 77-113 80-113 78-113

 Analysis Name: UST BTEX, MTBE in Water
 Batch number: F101953AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6027538	100	99	102	94
Blank	99	96	101	94
LCS	96	96	102	105
LCSD	97	96	101	104
MS	99	95	101	106

Limits: 80-116 77-113 80-113 78-113

 Analysis Name: UST BTEX, MTBE in Water
 Batch number: P101991AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6027536	99	105	94	92
Blank	98	105	94	92
LCS	98	106	94	93
LCSD	97	106	95	93
MS	97	108	93	92

Limits: 80-116 77-113 80-113 78-113

 Analysis Name: PAHs by 8270
 Batch number: 10193WAE026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6027536	84	89	67
6027537	84	88	68
6027538	62*	64	46*
6027539	92	95	76
Blank	82	82	65
LCS	91	91	75
LCSD	86	89	72

Limits: 64-121 63-114 47-114

 Analysis Name: EDB in Wastewater
 Batch number: 101910007A

	1,1,2,2-Tetrachloroethane
6027536	115
6027537	101
6027538	96
6027539	89
Blank	101

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech.
Reported: 07/27/10 at 01:05 PM

Group Number: 1202221

Surrogate Quality Control

LCS	96
LCSD	98
MS	80
MSD	81

Limits: 46-136

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	R	BMQL	B
N.D.	N	MPN	M
TNTC	T	CP Units	C
IU	I	NTU	N
umhos/cm	U	ng	ng
C	C	F	F
meq	meq	lb.	lb.
g	g	kg	kg
ug	ug	mg	mg
ml	ml	l	l
m3	m ³	ul	ul
<	<		
>	>		
J	J		
ppm	ppm		
ppb	ppb		
Dry weight basis	Dry weight basis		

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

Inorganic Qualifiers

A	TIC	B	V
B	A	E	E
C	GC/MS	M	D
D	C	N	S
E	C	S	M
N	(TIC)	U	C
P	C	W	
U	C	*	D
X,Y,Z	D	+	C

A NELAC...
M...
T...
U...
I...
W...
T...

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ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

August 03, 2010

Project: SUN: Philadelphia Refinery AOI-3

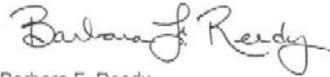
Submittal Date: 07/16/2010
Group Number: 1203493
PO Number: PHILA REFINERY AOI-3
State of Sample Origin: PAClient Sample DescriptionS-281_071510 Grab Water
S-284_071510 Grab WaterLancaster Labs (LLI) #6034571
6034572

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Megan Breen
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,



Barbara F. Reedy
Senior Specialist

Sample Description: S-281_071510 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232901 S-281_071510

LLI Sample # WW 6034571
 LLI Group # 1203493
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/15/2010 14:10 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/16/2010 17:20

West Chester PA 19381

Reported: 08/03/2010 13:31

Discard: 08/18/2010

S-281

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B			ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 10	10	5	10
10943	1,2-Dichloroethane	107-06-2	< 10	10	5	10
10943	Ethylbenzene	100-41-4	80	10	5	10
10943	Isopropylbenzene	98-82-8	220	20	5	10
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 10	10	5	10
10943	Toluene	108-88-3	< 10	10	5	10
10943	1,2,4-Trimethylbenzene	95-63-6	1,200	20	5	10
10943	1,3,5-Trimethylbenzene	108-67-8	520	20	5	10
10943	Xylene (Total)	1330-20-7	130	10	5	10

The reporting limits for the GC/MS volatile compounds were raised due to the level of non-target compounds.

GC/MS	Semivolatiles	SW-846 8270C	ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	5	5	0.9	1
07805	Naphthalene	91-20-3	38	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1

GC	Miscellaneous	SW-846 8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1

Metals	Dissolved	SW-846 6020	mg/l	mg/l	mg/l	
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z102071AA	07/26/2010 23:59	Daniel H Heller	10
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	Z102071AA	07/26/2010 23:59	Daniel H Heller	10
07805	PAHs by 8270	SW-846 8270C	1	10200WAJ026	07/31/2010 16:52	Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	1	10200WAJ026	07/20/2010 09:30	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980012A	07/21/2010 05:45	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101980012A	07/19/2010 08:45	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102016050003A	07/22/2010 12:16	David K Beck	1

*=This limit was used in the evaluation of the final result

Sample Description: S-281_071510 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232901 S-281_071510

LLI Sample # WW 6034571
 LLI Group # 1203493
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/15/2010 14:10 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/16/2010 17:20

West Chester PA 19381

Reported: 08/03/2010 13:31

Discard: 08/18/2010

S-281

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102016050003	07/21/2010 08:55	Denise K Connors	1

Sample Description: S-284_071510 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232901 S-284_071510

LLI Sample # WW 6034572
 LLI Group # 1203493
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/15/2010 14:40 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/16/2010 17:20

West Chester PA 19381

Reported: 08/03/2010 13:31

Discard: 08/18/2010

S-284

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z102071AA	07/27/2010 00:49	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	Z102071AA	07/27/2010 00:49	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10200WAJ026	07/31/2010 17:16	Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	1	10200WAJ026	07/20/2010 09:30	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980012A	07/21/2010 06:15	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101980012A	07/19/2010 08:45	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102016050003A	07/22/2010 12:18	David K Beck	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102016050003	07/21/2010 08:55	Denise K Connors	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/03/10 at 01:31 PM

Group Number: 1203493

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: Z102071AA Sample number(s): 6034571-6034572									
Benzene	< 1	1.	0.5	ug/l	88		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	84		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	90		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	90		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	95		76-120		
Toluene	< 1	1.	0.5	ug/l	90		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	96		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	96		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	91		80-120		
Batch number: 10200WAJ026 Sample number(s): 6034571-6034572									
Chrysene	< 5	5.	1	ug/l	96	96	82-112	0	30
Fluorene	< 5	5.	1	ug/l	99	100	82-113	2	30
Naphthalene	< 5	5.	1	ug/l	87	86	77-107	1	30
Phenanthrene	< 5	5.	1	ug/l	94	96	83-112	2	30
Pyrene	< 5	5.	1	ug/l	97	95	80-115	2	30
Batch number: 101980012A Sample number(s): 6034571-6034572									
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	121	121	60-140	0	20
Batch number: 102016050003A Sample number(s): 6034571-6034572									
Lead	< 0.0010	0.0010	0.00005	mg/l	102		90-115		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS %REC</u>	<u>MSD %REC</u>	<u>MS/MSD Limits</u>	<u>RPD</u>	<u>RPD MAX</u>	<u>BKG Conc</u>	<u>DUP Conc</u>	<u>DUP RPD</u>	<u>Dup RPD Max</u>
Batch number: Z102071AA Sample number(s): 6034571-6034572 UNSPK: P034028									
Benzene	96	95	80-126	1	30				
1,2-Dichloroethane	88	87	66-141	1	30				
Ethylbenzene	99	97	71-134	1	30				
Isopropylbenzene	99	98	75-128	1	30				
Methyl Tertiary Butyl Ether	100	97	72-126	3	30				
Toluene	98	96	80-125	2	30				
1,2,4-Trimethylbenzene	102	102	72-130	0	30				
1,3,5-Trimethylbenzene	103	101	72-131	2	30				
Xylene (Total)	99	97	79-125	1	30				

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/03/10 at 01:31 PM

Group Number: 1203493

Sample Matrix Quality Control

 Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS</u> <u>%REC</u>	<u>MSD</u> <u>%REC</u>	<u>MS/MSD</u> <u>Limits</u>	<u>RPD</u> <u>RPD</u>	<u>BKG</u> <u>MAX</u> <u>Conc</u>	<u>DUP</u> <u>Conc</u>	<u>DUP</u> <u>RPD</u>	<u>Dup</u> <u>RPD</u> <u>Max</u>
Batch number: 101980012A Ethylene dibromide	104		65-135		UNSPK: P034561 < 0.029	BKG: P034562 < 0.029	0 (1)	30
Batch number: 102016050003A Lead	103	104	75-125	1	UNSPK: P033036 < 0.0010	BKG: P033036 < 0.0010	41* (1)	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

 Analysis Name: UST BTEX, MTBE in Water
 Batch number: Z102071AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6034571	94	93	100	102
6034572	94	93	100	101
Blank	95	94	99	99
LCS	95	96	99	100
MS	95	96	100	100
MSD	95	95	100	101
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270

Batch number: 10200WAJ026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6034571	104	89	77
6034572	87	88	81
Blank	91	93	89
LCS	89	88	89
LCSD	86	88	86
Limits:	64-121	63-114	47-114

Analysis Name: EDB in Wastewater

Batch number: 101980012A

	1,1,2,2-Tetrachloroethane
6034571	179*
6034572	114
Blank	94
DUP	77
LCS	99
LCSD	98
MS	62
Limits:	46-136

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech.
Reported: 08/03/10 at 01:31 PM

Group Number: 1203493

Surrogate Quality Control

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	R	BMQL	B
N.D.	N	MPN	M
TNTC	T	CP Units	C
IU	I	NTU	N
umhos/cm	U	ng	ng
C	C	F	F
meq	m	lb.	lb.
g	g	kg	kg
ug	ug	mg	mg
ml	ml	l	l
m3	m ³	ul	ul
<	Less than - T		
>	Greater than		
J	Total Dissolved Solids (TDS) ≥ Method Detection Limit (MDL) or Lower Limit of Quantitation (LOQ)		
ppm	Parts per million - O		
ppb	Parts per billion		
Dry weight basis	Reported on a dry weight basis unless otherwise specified. T		

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers		Inorganic Qualifiers	
A	TIC	B	V
B	A	E	E
C	GC/MS	M	D
D	C	N	S
E	C	S	M
N	(TIC)	U	C
P	C	W	D
U	C	*	C
X,Y,Z	D	+	C

A NELAC...
M...
T... C... U... I... W... T...

WARRANTY AND LIMITS OF LIABILITY - THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL LANCASTER LABORATORIES BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES INCLUDING BUT NOT LIMITED TO DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF LANCASTER LABORATORIES AND (B) WHETHER LANCASTER LABORATORIES HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. W... L... S... T... C... L...

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

August 03, 2010

Project: SUN: Philadelphia Refinery AOI-3

Submittal Date: 07/19/2010
Group Number: 1203665
PO Number: PHILA REFINERY AOI-3
State of Sample Origin: PA

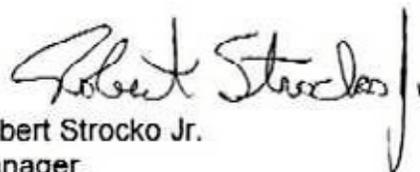
<u>Client Sample Description</u>	<u>Lancaster Labs (LLI) #</u>
S-283_071610 Grab Water	6035590
BF-103R_071610 Grab Water	6035591
S-16_071610 Grab Water	6035592
S-17_071610 Grab Water	6035593
S-18_071610 Grab Water	6035594
S-20_071610 Grab Water	6035595
S-22_071610 Grab Water	6035596

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Megan Breen
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,



Robert Strocko Jr.
Manager

Sample Description: S-283_071610 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232902 S-283_071610

LLI Sample # WW 6035590
 LLI Group # 1203665
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/16/2010 09:55 by SS

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/19/2010 16:25

Reported: 08/03/2010 13:54

Discard: 08/18/2010

S-283

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102031AA	07/22/2010 11:05	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	P102031AA	07/22/2010 11:05	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10201WAN026	08/01/2010 03:34	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	10201WAN026	07/21/2010 10:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102010009A	07/24/2010 09:28	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102010009A	07/20/2010 19:55	JoElla L Rice	1
06035	Lead	SW-846 6020	1	102026050005A	07/27/2010 10:51	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102026050005	07/21/2010 20:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: BF-103R_071610 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232902 BF-103R_071610

LLI Sample # WW 6035591
 LLI Group # 1203665
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/16/2010 10:45 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/19/2010 16:25

West Chester PA 19381

Reported: 08/03/2010 13:54

Discard: 08/18/2010

B103R

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.010	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	0.0012	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102031AA	07/22/2010 11:33	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	P102031AA	07/22/2010 11:33	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10201WAN026	08/01/2010 03:58	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	10201WAN026	07/21/2010 10:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102010009A	07/24/2010 09:58	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102010009A	07/20/2010 19:55	JoElla L Rice	1
06035	Lead	SW-846 6020	1	102026050005A	07/27/2010 10:53	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102026050005	07/21/2010 20:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Sample Description: S-16_071610 Grab Water
Philadelphia Refinery AOI-3
COC: 232902 S-16_071610

LLI Sample # WW 6035592
LLI Group # 1203665
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/16/2010 12:05 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/19/2010 16:25

West Chester PA 19381

Reported: 08/03/2010 13:54

Discard: 08/18/2010

S-16-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	220	5	3	5
10943	1,2-Dichloroethane	107-06-2	< 5	5	3	5
10943	Ethylbenzene	100-41-4	110	5	3	5
10943	Isopropylbenzene	98-82-8	88	10	3	5
10943	Methyl Tertiary Butyl Ether	1634-04-4	40	5	3	5
10943	Toluene	108-88-3	44	5	3	5
10943	1,2,4-Trimethylbenzene	95-63-6	400	10	3	5
10943	1,3,5-Trimethylbenzene	108-67-8	140	10	3	5
10943	Xylene (Total)	1330-20-7	380	5	3	5
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 24	24	5	5
07805	Fluorene	86-73-7	< 24	24	5	5
07805	Naphthalene	91-20-3	< 24	24	5	5
07805	Phenanthrene	85-01-8	29	24	5	5
07805	Pyrene	129-00-0	< 24	24	5	5
Due to the sample matrix an initial dilution was necessary to perform the analysis. Therefore, the reporting limits for the GC/MS semivolatile compounds were raised.						
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
This sample was filtered in the lab for dissolved metals.
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102031AA	07/22/2010 12:01	Anita M Dale	5
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102031AA	07/22/2010 12:01	Anita M Dale	5
07805	PAHs by 8270	SW-846 8270C	1	10201WAN026	08/01/2010 16:35	Linda M Hartenstine	5
07807	BNA Water Extraction	SW-846 3510C	1	10201WAN026	07/21/2010 10:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102010009A	07/24/2010 10:28	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102010009A	07/20/2010 19:55	JoElla L Rice	1

*=This limit was used in the evaluation of the final result



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Sample Description: S-16_071610 Grab Water
Philadelphia Refinery AOI-3
COC: 232902 S-16_071610

LLI Sample # WW 6035592
LLI Group # 1203665
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/16/2010 12:05 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/19/2010 16:25

West Chester PA 19381

Reported: 08/03/2010 13:54

Discard: 08/18/2010

S-16-

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution Factor
					Date	Time		
06035	Lead	SW-846 6020	1	102026050005A	07/27/2010	10:55	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102026050005	07/21/2010	20:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-17_071610 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232902 S-17_071610

LLI Sample # WW 6035593
 LLI Group # 1203665
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/16/2010 11:20 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/19/2010 16:25

West Chester PA 19381

Reported: 08/03/2010 13:54

Discard: 08/18/2010

S-17-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	4	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	5	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	2	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.0099	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102031AA	07/22/2010 12:29	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	P102031AA	07/22/2010 12:29	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10201WAN026	08/01/2010 16:59	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	10201WAN026	07/21/2010 10:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102010009A	07/24/2010 10:58	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102010009A	07/20/2010 19:55	JoElla L Rice	1
06035	Lead	SW-846 6020	1	102026050005A	07/27/2010 10:57	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102026050005	07/21/2010 20:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-18_071610 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232902 S-18_071610

LLI Sample # WW 6035594
LLI Group # 1203665
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/16/2010 12:40 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/19/2010 16:25

West Chester PA 19381

Reported: 08/03/2010 13:54

Discard: 08/18/2010

S-18-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	7	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.0098	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102031AA	07/22/2010 12:58	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	P102031AA	07/22/2010 12:58	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10201WAN026	08/01/2010 17:23	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	10201WAN026	07/21/2010 10:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102010009A	07/24/2010 11:28	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102010009A	07/20/2010 19:55	JoElla L Rice	1
06035	Lead	SW-846 6020	1	102026050005A	07/27/2010 10:59	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102026050005	07/21/2010 20:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-20_071610 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232902 S-20_071610

LLI Sample # WW 6035595
 LLI Group # 1203665
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/16/2010 13:15 by SS

SUN: Aquaterra Tech.

Submitted: 07/19/2010 16:25

PO Box 744

Reported: 08/03/2010 13:54

West Chester PA 19381

Discard: 08/18/2010

S-20-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	15	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	97	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	3	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.0098	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102031AA	07/22/2010 13:26	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	P102031AA	07/22/2010 13:26	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10201WAN026	08/01/2010 17:46	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	10201WAN026	07/21/2010 10:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102010009A	07/24/2010 11:58	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102010009A	07/20/2010 19:55	JoElla L Rice	1
06035	Lead	SW-846 6020	1	102026050005A	07/27/2010 11:01	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102026050005	07/21/2010 20:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-22_071610 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232902 S-22_071610

LLI Sample # WW 6035596
 LLI Group # 1203665
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/16/2010 14:05 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/19/2010 16:25

West Chester PA 19381

Reported: 08/03/2010 13:54

Discard: 08/18/2010

S-22-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	6	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	48	1	0.5	1
10943	Toluene	108-88-3	7	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	2	2	0.5	1
10943	Xylene (Total)	1330-20-7	17	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102031AA	07/22/2010 13:54	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	P102031AA	07/22/2010 13:54	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10201WAN026	08/01/2010 18:09	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	10201WAN026	07/21/2010 10:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102010009A	07/24/2010 12:28	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102010009A	07/20/2010 19:55	JoElla L Rice	1
06035	Lead	SW-846 6020	1	102026050005A	07/27/2010 11:03	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102026050005	07/21/2010 20:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/03/10 at 01:54 PM

Group Number: 1203665

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: P102031AA	Sample number(s): 6035590-6035596								
Benzene	< 1	1.	0.5	ug/l	92	91	79-120	2	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	74	73	70-130	2	30
Ethylbenzene	< 1	1.	0.5	ug/l	88	85	79-120	3	30
Isopropylbenzene	< 2	2.	0.5	ug/l	85	83	77-120	2	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	90	89	76-120	1	30
Toluene	< 1	1.	0.5	ug/l	94	93	79-120	1	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	87	87	74-120	1	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	89	87	75-120	2	30
Xylene (Total)	< 1	1.	0.5	ug/l	88	86	80-120	2	30
Batch number: 10201WAN026	Sample number(s): 6035590-6035596								
Chrysene	< 5	5.	1	ug/l	94	96	82-112	2	30
Fluorene	< 5	5.	1	ug/l	98	98	82-113	0	30
Naphthalene	< 5	5.	1	ug/l	95	95	77-107	0	30
Phenanthrene	< 5	5.	1	ug/l	97	97	83-112	0	30
Pyrene	< 5	5.	1	ug/l	99	100	80-115	2	30
Batch number: 102010009A	Sample number(s): 6035590-6035596								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	88	88	60-140	0	20
Batch number: 102026050005A	Sample number(s): 6035590-6035596								
Lead	< 0.0010	0.0010	0.00005	mg/l	102		90-115		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS %REC</u>	<u>MSD %REC</u>	<u>MS/MSD Limits</u>	<u>RPD</u>	<u>RPD MAX</u>	<u>BKG Conc</u>	<u>DUP Conc</u>	<u>DUP RPD</u>	<u>Dup RPD Max</u>
Batch number: P102031AA	Sample number(s): 6035590-6035596 UNSPK: P035586								
Benzene	97		80-126						
1,2-Dichloroethane	77		66-141						
Ethylbenzene	92		71-134						
Isopropylbenzene	90		75-128						
Methyl Tertiary Butyl Ether	95		72-126						
Toluene	101		80-125						
1,2,4-Trimethylbenzene	92		72-130						
1,3,5-Trimethylbenzene	92		72-131						
Xylene (Total)	93		79-125						

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/03/10 at 01:54 PM

Group Number: 1203665

Sample Matrix Quality Control

 Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 102010009A Ethylene dibromide	96		65-135			UNSPK: P035583 < 0.029	BKG: P035584 < 0.029	0 (1)	30
Batch number: 102026050005A Lead	102	107	75-125	3	20	UNSPK: P035639 0.0101	BKG: P035639 0.0100	0	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

 Analysis Name: UST BTEX, MTBE in Water
 Batch number: P102031AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6035590	93	102	102	92
6035591	93	102	102	90
6035592	93	102	101	93
6035593	93	104	102	100
6035594	92	104	102	93
6035595	91	101	102	95
6035596	92	101	102	91
Blank	92	102	103	91
LCS	92	104	103	92
LCSD	91	105	103	91
MS	92	107	103	92
Limits:	80-116	77-113	80-113	78-113

 Analysis Name: PAHs by 8270
 Batch number: 10201WAN026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6035590	98	94	89
6035591	91	89	84
6035592	81	70	55
6035593	87	85	72
6035594	97	92	87
6035595	77	70	49
6035596	91	90	86
Blank	97	94	93
LCS	100	98	93
LCSD	99	97	94
Limits:	64-121	63-114	47-114

 Analysis Name: EDB in Wastewater
 Batch number: 102010009A

 1,1,2,2-
 Tetrachloroethane

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech.
Reported: 08/03/10 at 01:54 PM

Group Number: 1203665

Surrogate Quality Control

6035590	90
6035591	97
6035592	126
6035593	101
6035594	85
6035595	85
6035596	125
Blank	99
DUP	104
LCS	83
LCSD	82
MS	91

Limits: 46-136

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	R	BMQL	B
N.D.	N	MPN	M
TNTC	T	CP Units	C
IU	I	NTU	N
umhos/cm	U	ng	ng
C	C	F	F
meq	meq	lb.	lb.
g	g	kg	kg
ug	ug	mg	mg
ml	ml	l	l
m3	m ³	ul	ul
<	<		
>	>		
J	J		
ppm	ppm		
ppb	ppb		
Dry weight basis	Dry weight basis		

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

Inorganic Qualifiers

A	TIC	B	V
B	A	E	E
C	GC/MS	M	D
D	C	N	S
E	C	S	M
N	(TIC)	U	C
P	C	W	
U	C	*	D
X,Y,Z	D	+	C

A... NELAC...
M...
T... C... U... I... W... T...

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ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

August 04, 2010

Project: SUN: Philadelphia Refinery AOI-3

Submittal Date: 07/22/2010
Group Number: 1204284
PO Number: PHILADELPHIA
State of Sample Origin: PA

<u>Client Sample Description</u>	<u>Lancaster Labs (LLI) #</u>
BF-104R_072110 Grab Water	6039482
BF-90_072110 Grab Water	6039483
BF-90D_072110 Grab Water	6039484
S-1_072110 Grab Water	6039485
S-10_072110 Grab Water	6039486
S-11_072110 Grab Water	6039487
S-12_072110 Grab Water	6039488
S-14_072110 Grab Water	6039489
S-2_072110 Grab Water	6039490
S-3_072110 Grab Water	6039491
S-8_072110 Grab Water	6039492
S-9_072110 Grab Water	6039493
S-5_072110 Grab Water	6039494

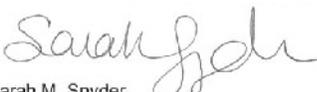
The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Megan Breen
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward

COPY TO

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,



Sarah M. Snyder
Senior Specialist

Sample Description: BF-104R_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 BF-104R_072110

LLI Sample # WW 6039482
 LLI Group # 1204284
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 11:15 by SS

SUN: Aquaterra Tech.

Submitted: 07/22/2010 15:25

PO Box 744

Reported: 08/04/2010 13:47

West Chester PA 19381

Discard: 08/19/2010

B104R

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	2	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102044AA	07/24/2010 00:47	Kelly E Keller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102044AA	07/24/2010 00:47	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	10204WAA026	08/02/2010 19:08	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10204WAA026	07/23/2010 09:45	Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	102050032A	07/27/2010 13:02	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102050032A	07/25/2010 13:35	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	102046050004A	07/30/2010 09:20	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102046050004	07/23/2010 18:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: BF-90_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 BF-90_072110

LLI Sample # WW 6039483
 LLI Group # 1204284
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 10:55 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

BF-90

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	3	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	15	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102044AA	07/24/2010 01:08	Kelly E Keller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102044AA	07/24/2010 01:08	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	10204WAA026	08/02/2010 19:32	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10204WAA026	07/23/2010 09:45	Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	102050032A	07/27/2010 14:31	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102050032A	07/25/2010 13:35	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	102046050004A	07/30/2010 09:22	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102046050004	07/23/2010 18:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: BF-90D_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 BF-90D_072110

LLI Sample # WW 6039484
 LLI Group # 1204284
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 10:40 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

BF90D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102044AA	07/24/2010 01:30	Kelly E Keller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102044AA	07/24/2010 01:30	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	10204WAA026	08/02/2010 19:55	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10204WAA026	07/23/2010 09:45	Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	102050032A	07/27/2010 15:01	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102050032A	07/25/2010 13:35	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	102046050004A	07/30/2010 09:23	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102046050004	07/23/2010 18:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-1_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-1_072110

LLI Sample # WW 6039485
 LLI Group # 1204284
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 15:00 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-1--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102044AA	07/24/2010 01:51	Kelly E Keller	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	F102044AA	07/24/2010 01:51	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	10204WAA026	08/03/2010 21:32	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10204WAA026	07/23/2010 09:45	Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	102050032A	07/27/2010 15:31	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102050032A	07/25/2010 13:35	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	102046050004A	07/30/2010 09:25	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102046050004	07/23/2010 18:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-10_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-10_072110

LLI Sample # WW 6039486
 LLI Group # 1204284
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 13:00 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-10-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	8	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	5	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102044AA	07/24/2010 02:13	Kelly E Keller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102044AA	07/24/2010 02:13	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	10204WAA026	08/02/2010 20:42	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10204WAA026	07/23/2010 09:45	Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	102050032A	07/27/2010 16:00	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102050032A	07/25/2010 13:35	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	102046050004A	07/30/2010 09:31	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102046050004	07/23/2010 18:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-11_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-11_072110

LLI Sample # WW 6039487
 LLI Group # 1204284
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 12:35 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-11-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	0.0012	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102044AA	07/24/2010 02:34	Kelly E Keller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102044AA	07/24/2010 02:34	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	10204WAA026	08/03/2010 21:55	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10204WAA026	07/23/2010 09:45	Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	102050032A	07/27/2010 16:30	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102050032A	07/25/2010 13:35	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	102046050004A	07/30/2010 09:33	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102046050004	07/23/2010 18:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-12_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-12_072110

LLI Sample # WW 6039488
 LLI Group # 1204284
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 12:25 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-12-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	4	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	4	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102044AA	07/24/2010 02:56	Kelly E Keller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102044AA	07/24/2010 02:56	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	10204WAA026	08/03/2010 22:19	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10204WAA026	07/23/2010 09:45	Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	102070054A	07/28/2010 03:56	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102070054A	07/27/2010 09:15	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102046050004A	07/30/2010 09:35	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102046050004	07/23/2010 18:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-14_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-14_072110

LLI Sample # WW 6039489
 LLI Group # 1204284
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 09:35 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-14-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102071AA	07/26/2010 07:16	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	F102071AA	07/26/2010 07:16	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10204WAA026	08/03/2010 07:01	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	10204WAA026	07/23/2010 09:45	Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	102070054A	07/28/2010 04:25	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102070054A	07/27/2010 09:15	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102046050004A	07/30/2010 09:36	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102046050004	07/23/2010 18:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-2_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-2_072110

LLI Sample # WW 6039490
LLI Group # 1204284
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 14:30 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-2--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102071AA	07/26/2010 07:37	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102071AA	07/26/2010 07:37	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10204WAA026	08/03/2010 07:24	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	10204WAA026	07/23/2010 09:45	Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	102070054A	07/28/2010 05:54	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102070054A	07/27/2010 09:15	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102046050004A	07/30/2010 09:38	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102046050004	07/23/2010 18:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-3_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-3_072110

LLI Sample # WW 6039491
 LLI Group # 1204284
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 14:00 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-3--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102071AA	07/26/2010 08:20	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	F102071AA	07/26/2010 08:20	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10207WAC026	08/01/2010 00:49	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	10207WAC026	07/26/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102070054A	07/28/2010 06:24	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102070054A	07/27/2010 09:15	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102046050004A	07/30/2010 09:40	Choon Y Tian	1

*=This limit was used in the evaluation of the final result

Sample Description: S-3_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-3_072110

LLI Sample # WW 6039491
LLI Group # 1204284
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 14:00 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-3--

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102046050004	07/23/2010 18:00	Mirit S Shenouda	1



Analysis Report

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Sample Description: S-8_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-8_072110

LLI Sample # WW 6039492
LLI Group # 1204284
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 13:15 by SS

SUN: Aquaterra Tech.

Submitted: 07/22/2010 15:25

PO Box 744

Reported: 08/04/2010 13:47

West Chester PA 19381

Discard: 08/19/2010

S-8--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 47	47	9	10
07805	Fluorene	86-73-7	< 47	47	9	10
07805	Naphthalene	91-20-3	< 47	47	9	10
07805	Phenanthrene	85-01-8	< 47	47	9	10
07805	Pyrene	129-00-0	< 47	47	9	10
Due to the sample matrix an initial dilution was necessary to perform the analysis. Therefore, the reporting limits for the GC/MS semivolatile compounds were raised.						
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	0.0011	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102071AA	07/26/2010 08:42	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102071AA	07/26/2010 08:42	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10207WAC026	08/01/2010 01:38	Linda M Hartenstine	10
07807	BNA Water Extraction	SW-846 3510C	1	10207WAC026	07/26/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102070054A	07/28/2010 06:54	James H Place	1

*=This limit was used in the evaluation of the final result

Sample Description: S-8_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-8_072110

LLI Sample # WW 6039492
LLI Group # 1204284
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 13:15 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-8--

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
07786	EDB Extraction	SW-846 8011	1	102070054A	07/27/2010	09:15	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102046050004A	07/30/2010	09:42	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102046050004	07/23/2010	18:00	Mirit S Shenouda	1

Sample Description: S-9_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-9_072110

LLI Sample # WW 6039493
 LLI Group # 1204284
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 12:55 by SS

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/22/2010 15:25

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-9--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	8	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102071AA	07/26/2010 09:04	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102071AA	07/26/2010 09:04	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10207WAC026	08/01/2010 02:28	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	10207WAC026	07/26/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102070054A	07/28/2010 07:24	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102070054A	07/27/2010 09:15	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102076050002A	07/29/2010 12:31	Choon Y Tian	1

*=This limit was used in the evaluation of the final result

Sample Description: S-9_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-9_072110

LLI Sample # WW 6039493
LLI Group # 1204284
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 12:55 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-9--

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102076050002	07/26/2010 20:30	Mirit S Shenouda	1

Sample Description: S-5_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-5_072110

LLI Sample # WW 6039494
LLI Group # 1204284
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 13:40 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-5--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	13	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	2	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102071AA	07/26/2010 09:25	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	F102071AA	07/26/2010 09:25	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10207WAC026	08/01/2010 03:17	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	10207WAC026	07/26/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102070054A	07/28/2010 07:53	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102070054A	07/27/2010 09:15	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102076050002A	07/29/2010 12:33	Choon Y Tian	1

*=This limit was used in the evaluation of the final result

Sample Description: S-5_072110 Grab Water
 Philadelphia Refinery AOI-3
 COC: 232905 S-5_072110

LLI Sample # WW 6039494
LLI Group # 1204284
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/21/2010 13:40 by SS

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/22/2010 15:25

West Chester PA 19381

Reported: 08/04/2010 13:47

Discard: 08/19/2010

S-5--

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102076050002	07/26/2010 20:30	Mirit S Shenouda	1

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/04/10 at 01:47 PM

Group Number: 1204284

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: F102044AA Sample number(s): 6039482-6039488									
Benzene	< 1	1.	0.5	ug/l	85		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	89		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	92		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	92		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	85		76-120		
Toluene	< 1	1.	0.5	ug/l	90		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	93		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	91		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	91		80-120		
Batch number: F102071AA Sample number(s): 6039489-6039494									
Benzene	< 1	1.	0.5	ug/l	90	87	79-120	3	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	91	90	70-130	2	30
Ethylbenzene	< 1	1.	0.5	ug/l	95	92	79-120	3	30
Isopropylbenzene	< 2	2.	0.5	ug/l	95	91	77-120	4	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	92	90	76-120	2	30
Toluene	< 1	1.	0.5	ug/l	95	91	79-120	4	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	92	90	74-120	3	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	91	88	75-120	3	30
Xylene (Total)	< 1	1.	0.5	ug/l	95	93	80-120	3	30
Batch number: 10204WAA026 Sample number(s): 6039482-6039490									
Chrysene	< 5	5.	1	ug/l	96	96	82-112	0	30
Fluorene	< 5	5.	1	ug/l	99	99	82-113	1	30
Naphthalene	< 5	5.	1	ug/l	97	96	77-107	1	30
Phenanthrene	< 5	5.	1	ug/l	100	97	83-112	3	30
Pyrene	< 5	5.	1	ug/l	98	97	80-115	1	30
Batch number: 10207WAC026 Sample number(s): 6039491-6039494									
Chrysene	< 5	5.	1	ug/l	93	90	82-112	3	30
Fluorene	< 5	5.	1	ug/l	106	105	82-113	1	30
Naphthalene	< 5	5.	1	ug/l	85	85	77-107	1	30
Phenanthrene	< 5	5.	1	ug/l	96	93	83-112	3	30
Pyrene	< 5	5.	1	ug/l	93	91	80-115	3	30
Batch number: 102050032A Sample number(s): 6039482-6039487									
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	104	100	60-140	4	20
Batch number: 102070054A Sample number(s): 6039488-6039494									
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	100	60-140	0	20
Batch number: 102046050004A Sample number(s): 6039482-6039492									
Lead	< 0.0010	0.0010	0.00005	mg/l	101		90-115		
			0						
Batch number: 102076050002A Sample number(s): 6039493-6039494									

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/04/10 at 01:47 PM

Group Number: 1204284

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Lead	< 0.0010	0.0010	0.00005	mg/l	101		90-115		
			0						

Sample Matrix Quality Control

 Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS %REC</u>	<u>MSD %REC</u>	<u>MS/MSD Limits</u>	<u>RPD</u>	<u>RPD MAX</u>	<u>BKG Conc</u>	<u>DUP Conc</u>	<u>DUP RPD</u>	<u>Dup RPD Max</u>
Batch number: F102044AA	Sample number(s): 6039482-6039488 UNSPK: P039067								
Benzene	90	94	80-126	4	30				
1,2-Dichloroethane	93	94	66-141	1	30				
Ethylbenzene	97	99	71-134	2	30				
Isopropylbenzene	98	99	75-128	1	30				
Methyl Tertiary Butyl Ether	87	88	72-126	1	30				
Toluene	95	97	80-125	2	30				
1,2,4-Trimethylbenzene	96	97	72-130	1	30				
1,3,5-Trimethylbenzene	94	97	72-131	3	30				
Xylene (Total)	96	98	79-125	2	30				
Batch number: F102071AA	Sample number(s): 6039489-6039494 UNSPK: 6039490								
Benzene	80		80-126						
1,2-Dichloroethane	82		66-141						
Ethylbenzene	83		71-134						
Isopropylbenzene	83		75-128						
Methyl Tertiary Butyl Ether	82		72-126						
Toluene	84		80-125						
1,2,4-Trimethylbenzene	80		72-130						
1,3,5-Trimethylbenzene	79		72-131						
Xylene (Total)	84		79-125						
Batch number: 102050032A	Sample number(s): 6039482-6039487 UNSPK: P039477 BKG: 6039482								
Ethylene dibromide	96		65-135			< 0.029	< 0.029	0 (1)	30
Batch number: 102070054A	Sample number(s): 6039488-6039494 UNSPK: P039609								
Ethylene dibromide	87	87	65-135	0	20				
Batch number: 102046050004A	Sample number(s): 6039482-6039492 UNSPK: P039473 BKG: P039473								
Lead	102	103	75-125	1	20	< 0.0010	< 0.0010	1 (1)	20
Batch number: 102076050002A	Sample number(s): 6039493-6039494 UNSPK: P041111 BKG: P041111								
Lead	101	102	75-125	1	20	< 0.0010	< 0.0010	31* (1)	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/04/10 at 01:47 PM

Group Number: 1204284

Surrogate Quality Control

 Analysis Name: UST BTEX, MTBE in Water
 Batch number: F102044AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6039482	95	97	102	95
6039483	96	98	103	95
6039484	96	98	102	96
6039485	95	98	102	94
6039486	95	98	103	97
6039487	95	99	103	97
6039488	97	99	102	98
Blank	96	97	102	95
LCS	96	99	103	99
MS	96	101	103	98
MSD	96	100	103	98
Limits:	80-116	77-113	80-113	78-113

 Analysis Name: UST BTEX, MTBE in Water
 Batch number: F102071AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6039489	97	100	103	95
6039490	96	97	103	95
6039491	96	99	101	93
6039492	96	97	105	95
6039493	96	98	103	96
6039494	98	98	103	97
Blank	98	99	103	95
LCS	96	99	102	97
LCSD	96	100	103	97
MS	97	99	102	97
Limits:	80-116	77-113	80-113	78-113

 Analysis Name: PAHs by 8270
 Batch number: 10204WAA026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6039482	89	102	91
6039483	85	98	83
6039484	87	100	92
6039485	88	96	91
6039486	87	98	83
6039487	89	100	88
6039488	90	100	85
6039489	95	98	89
6039490	93	98	75
Blank	89	97	93
LCS	96	102	96
LCSD	94	100	93
Limits:	64-121	63-114	47-114

 Analysis Name: PAHs by 8270
 Batch number: 10207WAC026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6039482	89	102	91
6039483	85	98	83
6039484	87	100	92
6039485	88	96	91
6039486	87	98	83
6039487	89	100	88
6039488	90	100	85
6039489	95	98	89
6039490	93	98	75
Blank	89	97	93
LCS	96	102	96
LCSD	94	100	93
Limits:	64-121	63-114	47-114

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech.
Reported: 08/04/10 at 01:47 PM

Group Number: 1204284

Surrogate Quality Control

6039491	82	99	75
6039492	69	87	71
6039493	87	102	80
6039494	89	102	82
Blank	88	103	83
LCS	85	102	83
LCSD	85	100	80

Limits: 64-121 63-114 47-114

Analysis Name: EDB in Wastewater
Batch number: 102050032A
 1,1,2,2-
 Tetrachloroethane

6039482	74
6039483	79
6039484	79
6039485	86
6039486	109
6039487	90
Blank	103
DUP	71
LCS	109
LCSD	105
MS	91

Limits: 46-136

Analysis Name: EDB in Wastewater
Batch number: 102070054A
 1,1,2,2-
 Tetrachloroethane

6039488	96
6039489	94
6039490	89
6039491	86
6039492	100
6039493	104
6039494	106
Blank	103
LCS	106
LCSD	105
MS	88
MSD	88

Limits: 46-136

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 1013Z Group# 1204284 Sample # 6037482-94

COC # 232905

Please print. Instructions on reverse side correspond with circled numbers.

<p>1 Client: <u>SUN-AQUATERRA</u> Acct. #: _____</p> <p>Project Name/#: <u>PH REF / AOT-3</u> PWSID #: _____</p> <p>Project Manager: <u>T. DOERR</u> P.O.#: _____</p> <p>Sampler: <u>S. SIKES</u> Quote #: _____</p> <p>Name of state where samples were collected: <u>PA</u></p>				<p>4 Matrix</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;"><input type="checkbox"/> Potable</td> <td style="width: 33%;"><input type="checkbox"/> Check if Applicable</td> <td style="width: 33%;"></td> </tr> <tr> <td><input type="checkbox"/> NPDES</td> <td><input type="checkbox"/> NPDES</td> <td></td> </tr> </table>			<input type="checkbox"/> Potable	<input type="checkbox"/> Check if Applicable		<input type="checkbox"/> NPDES	<input type="checkbox"/> NPDES		<p>5 Analyses Requested</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="10">Preservation Codes</th> </tr> <tr> <td style="width: 10%;">Lead (dissolved)</td> <td style="width: 10%;">1, 2-dichloroethane</td> <td style="width: 10%;">1,2,4-trichlorobenzene</td> <td style="width: 10%;">Benzene, Cumene</td> <td style="width: 10%;">Ethylbenzene, EDB</td> <td style="width: 10%;">MTBE, Toluene, Xylene (o,p)</td> <td style="width: 10%;">Chrysene, Fluorene</td> <td style="width: 10%;">Naphthalene, Anthracene</td> <td style="width: 10%;">Pyrene</td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> </tr> </table>										Preservation Codes										Lead (dissolved)	1, 2-dichloroethane	1,2,4-trichlorobenzene	Benzene, Cumene	Ethylbenzene, EDB	MTBE, Toluene, Xylene (o,p)	Chrysene, Fluorene	Naphthalene, Anthracene	Pyrene			<p>For Lab Use Only</p> <p>FSC: _____</p> <p>SCR#: _____</p>																																																																																																																																																								
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Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 10132 Group# 1204284 Sample # 6037482-94

COC # 232904

Please print. Instructions on reverse side correspond with circled numbers.

<p>1 Client: <u>SUN-AQUATERRA</u> Acct. #: _____</p> <p>Project Name/ #: <u>PH REF / AOI-3</u> PWSID #: _____</p> <p>Project Manager: <u>T. DOERR</u> P.O.#: _____</p> <p>Sampler: <u>S. SYKES</u> Quote #: _____</p> <p>Name of state where samples were collected: <u>PA</u></p>				<p>4</p> <p>Matrix</p> <p>Soil <input type="checkbox"/> Potable <input type="checkbox"/> Check if <input type="checkbox"/> Water <input type="checkbox"/> NPDES <input type="checkbox"/> Applicable Other _____</p>		<p>5 Analyses Requested</p> <p style="text-align: center;">Preservation Codes</p>										<p>For Lab Use Only</p> <p>FSC: _____</p> <p>SCR#: _____</p>						
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S-8-072110		7/21/10	1315	X			X		8	X	X	X	X	X	X	temp 1.0-2.6 °C						
S-9-072110		7/21/10	1255	X			X		8	X	X	X	X	X	X							
S-5-072110		7/21/10	1340	X			X		8	X	X	X	X	X	X							

7 Turnaround Time Requested (TAT) (please circle): Normal Rush
 (Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
 Date results are needed: _____
 Rush results requested by (please circle): Phone Fax E-mail
 Phone #: _____ Fax #: _____
 E-mail address: _____

Relinquished by: <u>[Signature]</u> / AQT	Date: <u>7/21/10</u>	Time: <u>1700</u>	Received by: <u>Fridge</u>	Date: <u>7/21/10</u>	Time: <u>1700</u>
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Relinquished by: <u>[Signature]</u>	Date: <u>7/21/10</u>	Time: <u>1525</u>	Received by: <u>[Signature]</u>	Date: _____	Time: _____
Relinquished by: _____	Date: _____	Time: _____	Received by: _____	Date: _____	Time: _____
Relinquished by: _____	Date: _____	Time: _____	Received by: <u>[Signature]</u>	Date: <u>7/22/10</u>	Time: <u>1525</u>

8 Data Package Options (please circle if required)

Type I (validation/NJ Reg)	TX TRRP-13	SDG Complete? Yes <input type="checkbox"/> No <input type="checkbox"/>
Type II (Tier II)	MA MCP CT RCP	
Type III (Reduced NJ)	Site-specific QC (MS/MSD/Dup)? Yes <input type="checkbox"/> No <input type="checkbox"/>	
Type IV (CLP SOW)	(If yes, indicate QC sample and submit triplicate volume.)	
Type VI (Raw Data Only)	Internal COC Required? Yes / No _____	

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	R	BMQL	B
N.D.	N	MPN	M
TNTC	T	CP Units	C
IU	I	NTU	N
umhos/cm	U	ng	ng
C	C	F	F
meq	meq	lb.	lb.
g	g	kg	kg
ug	ug	mg	mg
ml	ml	l	l
m3	m ³	ul	ul
<	<		
>	>		
J	J		
ppm	ppm		
ppb	ppb		
Dry weight basis	Dry weight basis		

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

Inorganic Qualifiers

A	TIC	B	V
B	A	E	E
C	GC/MS	M	D
D	C	N	S
E	C	S	M
N	(TIC)	U	C
P	C	W	
U	C	*	D
X,Y,Z	D	+	C

A... NELAC...
M...
T... C... U... I... W... T...

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ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

August 09, 2010

Project: SUN: Philadelphia Refinery AOI-3

Submittal Date: 07/23/2010
Group Number: 1204491
PO Number: PHILADELPHIA
State of Sample Origin: PA

<u>Client Sample Description</u>	<u>Lancaster Labs (LLI) #</u>
S-69D_072210 Grab Water	6040989
BF-99_072210 Grab Water	6040990
BF-107_072210 Grab Water	6040991
BF-88_072210 Grab Water	6040992
BF-106_072210 Grab Water	6040993
BF-108_072210 Grab Water	6040994
BF-105_072210 Grab Water	6040995
BF-100_072210 Grab Water	6040996
S-288_072210 Grab Water	6040997

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Megan Breen
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,



Chad A. Moline
Group Leader

Sample Description: S-69D_072210 Grab Water
 Philadelphia Refinery AOI-3
 COC: 229917 S-69D_072210

LLI Sample # WW 6040989
 LLI Group # 1204491
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/22/2010 16:30 by JW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/23/2010 16:15

West Chester PA 19381

Reported: 08/09/2010 13:33

Discard: 08/24/2010

S-69D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102082AA	07/27/2010 09:27	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102082AA	07/27/2010 09:27	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/03/2010 23:06	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/28/2010 16:21	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010 18:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010 06:58	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102086050002	07/27/2010 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: BF-99_072210 Grab Water
 Philadelphia Refinery AOI-3
 COC: 229917 BF-99_072210

LLI Sample # WW 6040990
 LLI Group # 1204491
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/22/2010 11:25 by JW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/23/2010 16:15

West Chester PA 19381

Reported: 08/09/2010 13:33

Discard: 08/24/2010

BF-99

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	7	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	9	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	20	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	12	2	0.5	1
10943	Xylene (Total)	1330-20-7	2	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	8	5	1	1
07805	Naphthalene	91-20-3	10	5	1	1
07805	Phenanthrene	85-01-8	7	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.0099	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102082AA	07/27/2010 09:49	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102082AA	07/27/2010 09:49	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/03/2010 23:29	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/30/2010 06:24	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010 18:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010 07:00	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102086050002	07/27/2010 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: BF-107_072210 Grab Water
 Philadelphia Refinery AOI-3
 COC: 229917 BF-107_072210

LLI Sample # WW 6040991
 LLI Group # 1204491
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/22/2010 11:00 by JW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/23/2010 16:15

West Chester PA 19381

Reported: 08/09/2010 13:33

Discard: 08/24/2010

BF107

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	52	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	7	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	78	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	70	5	0.9	1
07805	Pyrene	129-00-0	7	5	0.9	1
Surrogate recoveries are outside of QC limits for the initial GC/MS semivolatile analysis. The analysis was repeated outside of the required hold time and the surrogate recoveries are within the limits. The data reported is from the initial extraction of the sample.						
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102101AA	07/29/2010 20:04	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102101AA	07/29/2010 20:04	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/03/2010 23:52	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102110004A	08/03/2010 02:18	James H Place	1

*=This limit was used in the evaluation of the final result

Sample Description: BF-107_072210 Grab Water
 Philadelphia Refinery AOI-3
 COC: 229917 BF-107_072210

LLI Sample # WW 6040991
LLI Group # 1204491
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/22/2010 11:00 by JW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/23/2010 16:15

West Chester PA 19381

Reported: 08/09/2010 13:33

Discard: 08/24/2010

BF107

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution Factor
					Date	Time		
07786	EDB Extraction	SW-846 8011	1	102110004A	07/30/2010	11:45	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010	07:05	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102086050002	07/27/2010	21:00	Mirit S Shenouda	1

Sample Description: BF-88_072210 Grab Water
 Philadelphia Refinery AOI-3
 COC: 229917 BF-88_072210

LLI Sample # WW 6040992
LLI Group # 1204491
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/22/2010 10:40 by JW

SUN: Aquaterra Tech.

Submitted: 07/23/2010 16:15

PO Box 744

Reported: 08/09/2010 13:33

West Chester PA 19381

Discard: 08/24/2010

BF-88

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102082AA	07/27/2010 10:53	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102082AA	07/27/2010 10:53	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010 00:16	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/30/2010 07:24	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010 18:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010 07:07	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102086050002	07/27/2010 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: BF-106_072210 Grab Water
 Philadelphia Refinery AOI-3
 COC: 229917 BF-106_072210

LLI Sample # WW 6040993
 LLI Group # 1204491
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/22/2010 10:20 by JW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/23/2010 16:15

West Chester PA 19381

Reported: 08/09/2010 13:33

Discard: 08/24/2010

BF106

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	130	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	56	1	0.5	1
10943	Isopropylbenzene	98-82-8	31	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	2	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	130	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	25	2	0.5	1
10943	Xylene (Total)	1330-20-7	19	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	28	5	0.9	1
07805	Naphthalene	91-20-3	37	5	0.9	1
07805	Phenanthrene	85-01-8	29	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102082AA	07/27/2010 11:15	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102082AA	07/27/2010 11:15	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010 00:39	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/30/2010 07:54	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010 18:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010 07:09	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102086050002	07/27/2010 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: BF-108_072210 Grab Water
 Philadelphia Refinery AOI-3
 COC: 229917 BF-108_072210

LLI Sample # WW 6040994
 LLI Group # 1204491
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/22/2010 10:25 by JW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/23/2010 16:15

West Chester PA 19381

Reported: 08/09/2010 13:33

Discard: 08/24/2010

BF108

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	120	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102082AA	07/27/2010 11:58	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	F102082AA	07/27/2010 11:58	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010 01:03	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/30/2010 09:23	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010 18:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010 07:11	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102086050002	07/27/2010 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: BF-105_072210 Grab Water
 Philadelphia Refinery AOI-3
 COC: 229917 BF-105_072210

LLI Sample # WW 6040995
 LLI Group # 1204491
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/22/2010 08:55 by JW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/23/2010 16:15

West Chester PA 19381

Reported: 08/09/2010 13:33

Discard: 08/24/2010

BF105

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102082AA	07/27/2010 12:19	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	F102082AA	07/27/2010 12:19	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010 01:26	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/30/2010 09:54	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010 18:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010 07:13	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102086050002	07/27/2010 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: BF-100_072210 Grab Water
 Philadelphia Refinery AOI-3
 COC: 229917 BF-100_072210

LLI Sample # WW 6040996
 LLI Group # 1204491
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/22/2010 09:15 by JW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/23/2010 16:15

West Chester PA 19381

Reported: 08/09/2010 13:33

Discard: 08/24/2010

BF100

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102082AA	07/27/2010 12:41	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	F102082AA	07/27/2010 12:41	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010 01:50	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/30/2010 10:24	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010 18:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010 07:14	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102086050002	07/27/2010 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-288_072210 Grab Water
 Philadelphia Refinery AOI-3
 COC: 229917 S-288_072210

LLI Sample # WW 6040997
 LLI Group # 1204491
 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/22/2010 09:35 by JW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/23/2010 16:15

West Chester PA 19381

Reported: 08/09/2010 13:33

Discard: 08/24/2010

S-288

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	280	10	5	10
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	20	1	0.5	1
10943	Isopropylbenzene	98-82-8	27	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	7	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	47	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	16	2	0.5	1
10943	Xylene (Total)	1330-20-7	69	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	8	5	1	1
07805	Naphthalene	91-20-3	14	5	1	1
07805	Phenanthrene	85-01-8	9	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
Surrogate recoveries are outside of QC limits for the initial GC/MS semivolatile analysis. The analysis was repeated outside of the required hold time and the surrogate recoveries are within the limits. The data reported is from the initial extraction of the sample.						
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.0099	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102082AA	07/27/2010 13:03	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	2	F102082AA	07/27/2010 13:25	Anita M Dale	10
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102082AA	07/27/2010 13:03	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102082AA	07/27/2010 13:25	Anita M Dale	10
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010 02:13	Matthew S Woods	1

*=This limit was used in the evaluation of the final result

Sample Description: S-288_072210 Grab Water
Philadelphia Refinery AOI-3
COC: 229917 S-288_072210

LLI Sample # WW 6040997
LLI Group # 1204491
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/22/2010 09:35 by JW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/23/2010 16:15

West Chester PA 19381

Reported: 08/09/2010 13:33

Discard: 08/24/2010

S-288

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:45	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/30/2010 10:53	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010 18:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010 07:16	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102086050002	07/27/2010 21:00	Mirit S Shenouda	1

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/09/10 at 01:33 PM

Group Number: 1204491

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F102082AA									
Sample number(s): 6040989-6040990, 6040992-6040997									
Benzene	< 1	1.	0.5	ug/l	92		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	92		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	95		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	95		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	90		76-120		
Toluene	< 1	1.	0.5	ug/l	96		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	92		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	91		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	95		80-120		
Batch number: P102101AA									
Sample number(s): 6040991									
Benzene	< 1	1.	0.5	ug/l	95		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	78		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	85		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	81		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	93		76-120		
Toluene	< 1	1.	0.5	ug/l	92		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	84		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	85		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	85		80-120		
Batch number: 10208WAB026									
Sample number(s): 6040989-6040997									
Chrysene	< 5	5.	1	ug/l	88	92	82-112	5	30
Fluorene	< 5	5.	1	ug/l	94	97	82-113	3	30
Naphthalene	< 5	5.	1	ug/l	88	94	77-107	6	30
Phenanthrene	< 5	5.	1	ug/l	95	98	83-112	2	30
Pyrene	< 5	5.	1	ug/l	97	100	80-115	3	30
Batch number: 102080003A									
Sample number(s): 6040989-6040990, 6040992-6040997									
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	96	60-140	4	20
Batch number: 102110004A									
Sample number(s): 6040991									
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	92	60-140	4	20
Batch number: 102086050002A									
Sample number(s): 6040989-6040997									
Lead	< 0.0010	0.0010	0.00005	mg/l	99		90-115		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/09/10 at 01:33 PM

Group Number: 1204491

<u>Analysis Name</u>	<u>MS</u> <u>%REC</u>	<u>MSD</u> <u>%REC</u>	<u>MS/MSD</u> <u>Limits</u>	<u>RPD</u>	<u>RPD</u> <u>MAX</u>	<u>BKG</u> <u>Conc</u>	<u>DUP</u> <u>Conc</u>	<u>DUP</u> <u>RPD</u>	<u>Dup RPD</u> <u>Max</u>
Batch number: F102082AA	Sample number(s): 6040989-6040990,6040992-6040997 UNSPK: P039238								
Benzene	94	95	80-126	1	30				
1,2-Dichloroethane	91	92	66-141	1	30				
Ethylbenzene	100	99	71-134	1	30				
Isopropylbenzene	101	100	75-128	2	30				
Methyl Tertiary Butyl Ether	89	87	72-126	2	30				
Toluene	100	99	80-125	1	30				
1,2,4-Trimethylbenzene	95	95	72-130	0	30				
1,3,5-Trimethylbenzene	93	94	72-131	1	30				
Xylene (Total)	99	98	79-125	1	30				
Batch number: P102101AA	Sample number(s): 6040991 UNSPK: P040514								
Benzene	110	110	80-126	0	30				
1,2-Dichloroethane	88	87	66-141	1	30				
Ethylbenzene	88	89	71-134	1	30				
Isopropylbenzene	76	78	75-128	3	30				
Methyl Tertiary Butyl Ether	105	105	72-126	0	30				
Toluene	103	104	80-125	0	30				
1,2,4-Trimethylbenzene	78	78	72-130	0	30				
1,3,5-Trimethylbenzene	77	77	72-131	1	30				
Xylene (Total)	87	89	79-125	1	30				
Batch number: 102080003A	Sample number(s): 6040989-6040990,6040992-6040997 UNSPK: 6040989 BKG: 6040990								
Ethylene dibromide	43*		65-135			< 0.030	< 0.029	0 (1)	30
Batch number: 102110004A	Sample number(s): 6040991 UNSPK: P044524 BKG: P044525								
Ethylene dibromide	100		65-135			< 0.030	< 0.030	0 (1)	30
Batch number: 102086050002A	Sample number(s): 6040989-6040997 UNSPK: P042035 BKG: P042035								
Lead	98	103	75-125	4	20	0.0078	0.0081	5	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water

Batch number: F102082AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6040989	95	98	103	94
6040990	93	98	101	97
6040992	93	98	101	93
6040993	93	98	101	110
6040994	94	97	102	95
6040995	95	98	100	94
6040996	94	98	102	94
6040997	94	97	103	100
Blank	96	98	102	93
LCS	93	98	101	97
MS	94	99	103	98
MSD	94	99	102	96
Limits:	80-116	77-113	80-113	78-113

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/09/10 at 01:33 PM

Group Number: 1204491

Surrogate Quality Control

 Analysis Name: UST BTEX, MTBE in Water
 Batch number: P102101AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6040991	93	101	99	96
Blank	93	102	102	92
LCS	92	105	102	94
MS	93	104	100	91
MSD	93	103	102	95
Limits:	80-116	77-113	80-113	78-113

 Analysis Name: PAHs by 8270
 Batch number: 10208WAB026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6040989	83	94	90
6040990	83	83	83
6040991	65	37*	32*
6040992	82	94	90
6040993	99	63	80
6040994	80	92	92
6040995	89	100	97
6040996	82	90	80
6040997	42*	44*	41*
Blank	94	97	94
LCS	88	95	89
LCSD	92	97	89
Limits:	64-121	63-114	47-114

 Analysis Name: EDB in Wastewater
 Batch number: 102080003A

	1,1,2,2-Tetrachloroethane
6040989	51
6040990	48
6040992	90
6040993	113
6040994	73
6040995	61
6040996	61
6040997	52
Blank	109
DUP	58
LCS	105
LCSD	96
MS	64
Limits:	46-136

 Analysis Name: EDB in Wastewater
 Batch number: 102110004A

	1,1,2,2-Tetrachloroethane
--	---------------------------

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech.
Reported: 08/09/10 at 01:33 PM

Group Number: 1204491

Surrogate Quality Control

6040991	100
Blank	90
DUP	100
LCS	96
LCSD	93
MS	98

Limits: 46-136

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 10132 Group# 1204491 Sample # 6040989-97

COC # 229917

Please print. Instructions on reverse side correspond with circled numbers.

1 Client: <u>SUN - AQUATERRA</u> Acct. #: _____ Project Name/#: <u>PHILAREF /AOI-3</u> PWSID #: _____ Project Manager: <u>T. DOERR</u> P.O.#: _____ Sampler: <u>J. Williams</u> Quote #: _____ Name of state where samples were collected: <u>PA</u>				4 Matrix <input type="checkbox"/> Probable <input type="checkbox"/> Check if NPIES Applicable		2 Analyses Requested Preservation Codes						For Lab Use Only FSC: _____ SCR#: _____				
						Lead (dissolved) 1,2 - dichloroethane 1,2,4 / 1,3,5 Trinitrobenzene Benzene, (cumene) Ethylbenzene, (EDB) mTol, Toluene Xylenes (Total) Chrysene, Fluorene Naphthalene Phenanthrene Pyrene						Preservation Codes H=HCl T=Thiosulfate N=HNO ₃ B=NaOH S=H ₂ SO ₄ O=Other		6 Temperature of samples upon receipt (if requested)		
2 Sample Identification				Date Collected	Time Collected	3 Grab Composite	Soil	Water	Other	Total # of Containers	Remarks					
S-690 - 072210				7/22/10	1630	X	X			8	temp 0.7-2.6°C					
BF-99 - 072210					1125	X	X			8						
BF-107 - 072210					1100	X	X			8						
BF-88 - 072210					1040	X	X			8						
BF-106 - 072210					1020	X	X			8						
BF-108 - 072210					1025	X	X			8						
BF-105 - 072210					0855	X	X			8						
BF-100 - 072210					0915	X	X			8						
S-288 - 072210					0935	X	X			8						
7 Turnaround Time Requested (TAT) (please circle): Normal Rush (Rush TAT is subject to Lancaster Laboratories approval and surcharge.) Date results are needed: _____ Rush results requested by (please circle): Phone Fax E-mail Phone #: _____ Fax #: _____ E-mail address: _____				Relinquished by: _____ Date: <u>7/22/10</u> Time: <u>0600</u>		Received by: <u>Sample Fidge</u> Date: <u>7/22/10</u> Time: <u>0600</u>		Relinquished by: _____ Date: <u>7/23/10</u> Time: <u>1140</u>		Received by: <u>J. Toney</u> Date: <u>7/23/10</u> Time: <u>1140</u>		Relinquished by: _____ Date: <u>7/23/10</u> Time: <u>1615</u>		Received by: _____ Date: <u>7/23/10</u> Time: <u>1615</u>		
8 Data Package Options (please circle if required) Type I (validation/NJ Reg) TX TRRP-13 Yes No Type II (Tier II) MA MCP CT RCP Type III (Reduced NJ) Site-specific QC (MS/MSD/Dup)? Yes No Type IV (CLP SOW) <small>(if yes, indicate QC sample and submit triplicate volume.)</small> Type VI (Raw Data Only) Internal COC Required? Yes / No				SDG Complete? Yes No												

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	R	BMQL	B
N.D.	N	MPN	M
TNTC	T	CP Units	C
IU	I	NTU	N
umhos/cm	U	ng	ng
C	C	F	F
meq	meq	lb.	lb.
g	g	kg	kg
ug	ug	mg	mg
ml	ml	l	l
m3	m ³	ul	ul
<	<		
>	>		
J	J		
ppm	ppm		
ppb	ppb		
Dry weight basis	Dry weight basis		

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

Inorganic Qualifiers

A	TIC	B	V
B	A	E	E
C	GC/MS	M	D
D	C	N	S
E	C	S	M
N	(TIC)	U	C
P	C	W	
U	C	*	D
X,Y,Z	D	+	C

A

M

T

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ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

August 04, 2010

Project: SUN: Philadelphia Refinery AOI-3

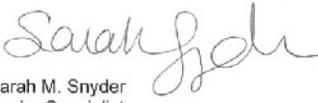
Submittal Date: 07/26/2010
Group Number: 1204677
PO Number: PHILADELPHIA
State of Sample Origin: PAClient Sample DescriptionS-284D Grab Water
S-280D Grab WaterLancaster Labs (LLI) #6042088
6042089

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Megan Breen
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,



Sarah M. Snyder
Senior Specialist

Sample Description: S-284D Grab Water
Philadelphia Refinery AOI-3
COC: 235655 S-284D

LLI Sample # WW 6042088
LLI Group # 1204677
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/23/2010 13:40 by JRW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/26/2010 16:00

West Chester PA 19381

Reported: 08/04/2010 09:53

Discard: 08/19/2010

S284D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102122AA	07/31/2010 20:55	Kelly E Keller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102122AA	07/31/2010 20:55	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAF026	07/31/2010 03:35	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAF026	07/28/2010 09:45	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102090006A	07/31/2010 13:12	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102090006A	07/28/2010 14:45	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102096050001A	07/30/2010 08:03	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102096050001	07/28/2010 20:30	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Sample Description: S-280D Grab Water
Philadelphia Refinery AOI-3
COC: 235655 S-280D

LLI Sample # WW 6042089
LLI Group # 1204677
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-3

Collected: 07/23/2010 14:15 by JRW

SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/26/2010 16:00

West Chester PA 19381

Reported: 08/04/2010 09:53

Discard: 08/19/2010

S280D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles SW-846 8260B						
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles SW-846 8270C						
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous SW-846 8011						
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals Dissolved SW-846 6020						
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11
 This sample was filtered in the lab for dissolved metals.
 Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102111AA	07/30/2010 21:18	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMS	SW-846 8260B	1	P102111AA	07/30/2010 21:18	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAF026	07/31/2010 04:01	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAF026	07/28/2010 09:45	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102090006A	07/31/2010 13:42	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102090006A	07/28/2010 14:45	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102096050001A	07/30/2010 08:05	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102096050001	07/28/2010 20:30	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/04/10 at 09:53 AM

Group Number: 1204677

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	<u>LCS %REC</u>	<u>LCSD %REC</u>	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: P102111AA Sample number(s): 6042089									
Benzene	< 1	1.	0.5	ug/l	101		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	83		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	89		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	85		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	98		76-120		
Toluene	< 1	1.	0.5	ug/l	96		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	89		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	90		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	89		80-120		
Batch number: P102122AA Sample number(s): 6042088									
Benzene	< 1	1.	0.5	ug/l	99	99	79-120	0	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	83	82	70-130	0	30
Ethylbenzene	< 1	1.	0.5	ug/l	94	89	79-120	6	30
Isopropylbenzene	< 2	2.	0.5	ug/l	91	82	77-120	10	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	99	99	76-120	0	30
Toluene	< 1	1.	0.5	ug/l	97	98	79-120	1	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	92	89	74-120	3	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	92	91	75-120	1	30
Xylene (Total)	< 1	1.	0.5	ug/l	94	85	80-120	9	30
Batch number: 10208WAF026 Sample number(s): 6042088-6042089									
Chrysene	< 5	5.	1	ug/l	97	96	82-112	1	30
Fluorene	< 5	5.	1	ug/l	97	89	82-113	8	30
Naphthalene	< 5	5.	1	ug/l	88	91	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	95	97	83-112	2	30
Pyrene	< 5	5.	1	ug/l	102	102	80-115	0	30
Batch number: 102090006A Sample number(s): 6042088-6042089									
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	88	60-140	9	20
Batch number: 102096050001A Sample number(s): 6042088-6042089									
Lead	< 0.0010	0.0010	0.00005	mg/l	98		90-115		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS %REC</u>	<u>MSD %REC</u>	<u>MS/MSD Limits</u>	<u>RPD</u>	<u>RPD MAX</u>	<u>BKG Conc</u>	<u>DUP Conc</u>	<u>DUP RPD</u>	<u>Dup RPD Max</u>
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*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

 Client Name: SUN: Aquaterra Tech.
 Reported: 08/04/10 at 09:53 AM

Group Number: 1204677

Sample Matrix Quality Control

 Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
 Background (BKG) = the sample used in conjunction with the duplicate

<u>Analysis Name</u>	<u>MS</u> <u>%REC</u>	<u>MSD</u> <u>%REC</u>	<u>MS/MSD</u> <u>Limits</u>	<u>RPD</u> <u>RPD</u>	<u>RPD</u> <u>MAX</u>	<u>BKG</u> <u>Conc</u>	<u>DUP</u> <u>Conc</u>	<u>DUP</u> <u>RPD</u>	<u>Dup RPD</u> <u>Max</u>
Batch number: P102111AA	Sample number(s): 6042089 UNSPK: P040042								
Benzene	111	110	80-126	0	30				
1,2-Dichloroethane	86	87	66-141	0	30				
Ethylbenzene	95	95	71-134	0	30				
Isopropylbenzene	89	89	75-128	1	30				
Methyl Tertiary Butyl Ether	105	104	72-126	1	30				
Toluene	105	105	80-125	0	30				
1,2,4-Trimethylbenzene	89	88	72-130	1	30				
1,3,5-Trimethylbenzene	93	92	72-131	1	30				
Xylene (Total)	94	95	79-125	1	30				
Batch number: P102122AA	Sample number(s): 6042088 UNSPK: P040407								
Benzene	101		80-126						
1,2-Dichloroethane	82		66-141						
Ethylbenzene	91		71-134						
Isopropylbenzene	89		75-128						
Methyl Tertiary Butyl Ether	97		72-126						
Toluene	95		80-125						
1,2,4-Trimethylbenzene	83		72-130						
1,3,5-Trimethylbenzene	92		72-131						
Xylene (Total)	90		79-125						
Batch number: 102090006A	Sample number(s): 6042088-6042089 UNSPK: P042079 BKG: P041787								
Ethylene dibromide	57*		65-135			< 0.029	< 0.030	0 (1)	30
Batch number: 102096050001A	Sample number(s): 6042088-6042089 UNSPK: P042083 BKG: P042083								
Lead	102	99	75-125	4	20	0.0011	0.0011	0 (1)	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water

Batch number: P102111AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6042089	95	102	100	92
Blank	93	101	101	92
LCS	93	104	101	95
MS	93	104	102	92
MSD	93	103	100	91
Limits:	80-116	77-113	80-113	78-113

Analysis Name: UST BTEX, MTBE in Water

Batch number: P102122AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6042088	95	100	104	89

*- Outside of specification

**-This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech.
Reported: 08/04/10 at 09:53 AM

Group Number: 1204677

Surrogate Quality Control

Blank	93	102	103	95
LCS	93	102	102	97
LCSD	93	104	102	86
MS	94	103	101	96

Limits: 80-116 77-113 80-113 78-113

Analysis Name: PAHs by 8270
Batch number: 10208WAF026
Nitrobenzene-d5

2-Fluorobiphenyl

Terphenyl-d14

6042088	101	95	89
6042089	97	94	85
Blank	105	100	87
LCS	96	94	92
LCSD	97	96	92

Limits: 64-121 63-114 47-114

Analysis Name: EDB in Wastewater
Batch number: 102090006A
1,1,2,2-Tetrachloroethane

6042088	86
6042089	66
Blank	105
DUP	123
LCS	104
LCSD	97
MS	59

Limits: 46-136

*- Outside of specification

** - This limit was used in the evaluation of the final result for the blank

- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 10132 Group# 1204677 Sample # 6042088-89

COC # 235655

Please print. Instructions on reverse side correspond with circled numbers.

For Lab Use Only

FSC: _____
SCR#: 89538

1 Client: Agatecca Technology Acct. #: _____
 Project Name/#: sun Philly Refinery AOI-3 PWSID #: _____
 Project Manager: Tiffany Doell P.O.#: _____
 Sampler: JR Williams Quote #: _____
 Name of state where samples were collected: PA

4

5 Preservation Codes										
Lead (dissolved)	1,2,4-Trichlorobenzene	1,2,4-Trichlorobenzene	1,3,5-Trimecylbenzene	1,3,5-Trimecylbenzene	Ethylbenzene	Ethylbenzene	Ethylbenzene	Ethylbenzene	Ethylbenzene	Ethylbenzene

6

Preservation Codes
 H=HCl T=Thiosulfate
 N=HNO₃ B=NaOH
 S=H₂SO₄ O=Other

lab to filter samples

Remarks

2

Sample ID	7/23/10*	1340	X	X	8	X	X	X	X	X	X	X	Remarks
S-284D	7/23/10*	1340	X	X	8	X	X	X	X	X	X	X	temp 0.6-1.3°C
S-280D	7/23/10	1415	X	X	8	X	X	X	X	X	X	X	* Collection date per labels + TD. 7/27/10
													5 day TAT per D.W. 7/27/10

7 Turnaround Time Requested (TAT) (please circle): Normal Rush
 (Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
 Date results are needed: _____
 Rush results requested by (please circle): Phone Fax E-mail
 Phone #: _____ Fax #: _____
 E-mail address: _____

Relinquished by:	Date	Time	Received by:	Date	Time
<u>Bottle Storage</u>			<u>J. Ryan</u>	<u>7/22</u>	<u>11:55</u>
<u>J. Ryan</u>	<u>7/23</u>	<u>10:00</u>	<u>J. Ryan</u>	<u>7/23/10</u>	<u>13:30</u>
<u>J. Ryan</u>	<u>7/23/10</u>	<u>16:15</u>	<u>Sample Fridge</u>	<u>7/23/10</u>	<u>16:15</u>
<u>J. Ryan</u>	<u>7/24/10</u>	<u>11:35</u>	<u>J. Ryan</u>	<u>7/24/10</u>	<u>11:25</u>
<u>J. Ryan</u>	<u>7/26/10</u>	<u>16:00</u>	<u>J. Ryan</u>	<u>7/26/10</u>	<u>16:00</u>

8 Data Package Options (please circle if required)

Type I (validation/NJ Reg)	TX TRRP-13	SDG Complete?
Type II (Tier II)	MA MCP CT RCP	Yes No
Type III (Reduced NJ)	Site-specific QC (MS/MSD/Dup)? Yes No	
Type IV (CLP SOW)	(If yes, indicate QC sample and submit triplicate volume.)	
Type VI (Raw Data Only)	Internal COC Required? Yes / No	

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	R	BMQL	B
N.D.	N	MPN	M
TNTC	T	CP Units	C
IU	I	NTU	N
umhos/cm	U	ng	N
C	C	F	F
meq	M	lb.	L
g	G	kg	K
ug	U	mg	M
ml	M	l	L
m3	M	ul	U
<	Less than - T		
>	Greater than		
J	Judgmental		
ppm	Parts per million - O		
ppb	Parts per billion		
Dry weight basis	Reported on a dry weight basis		

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers		Inorganic Qualifiers	
A	TIC	B	V
B	A	E	E
C	GC/MS	M	D
D	C	N	S
E	C	S	M
N	(TIC)	U	C
P	C	W	D
U	C	*	C
X,Y,Z	D	+	C

... NELAC ...
 M ...
 T ... C ... U ... I ... W ... T ...

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APPENDIX E

July 2010 Groundwater Sampling Field Summary Report

Appendix E
July 2010 Groundwater Sampling Field Summary
AOI 3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

WELL INFO					FIELD READINGS (pre-purge)						FIELD READINGS (post-purge)							FIELD READINGS (sampling)			
Location ID	Depth to Bottom (ft bgs)	Depth to Water (ft btic) ⁽¹⁾	Depth to Product (ft btic)	Product Thickness (ft)	Purge Start	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conductivity (mS/cm)	Purge Complete	Approx. Purge Rate (gpm) ⁽²⁾	Volume Purged (gal)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conductivity (mS/cm)	Date Sampled	Sample Time	
BF-100	22.08	12.00	NP	NP	0900	14.30	6.21	1.7	7.08	1.035	915	1.5	20	13.74	20.45	0.3	6.66	1.035	7/22/2010	0915	
BF-103R	24.62	14.25	NP	NP	1030	16.09	6.68	26.6	7.14	1.090	1045	1.5	21.5	16.14	3.13	40.9	6.90	1.471	7/16/2010	1045	
BF-104	16.81	6.54	NP	NP	1100	16.83	6.17	17.4	6.25	1.768	1115	1.5	22	19.32	1.57	0	6.38	1.395	7/21/2010	1115	
BF-105	19.03	11.66	NP	NP	0840	13.57	6.22	29.2	2.60	1.107	855	1.5	15	15.87	2.02	21.3	6.63	1.017	7/22/2010	0855	
BF-106	22.30	13.32	NP	NP	1000	17.17	10.32	-23.8	7.86	1.380	1020	1.5	17	15.05	6.01	-87.5	7.29	1.353	7/22/2010	1020	
BF-107	32.34	11.96	NP	NP	1045	17.42	7.14	-27.1	6.57	0.972	1100	1.5	40	15.44	4.13	-49	6.51	0.906	7/22/2010	1100	
BF-108	82.18	10.85	NP	NP	1000	16.11	8.23	-72	7.40	0.614	1025	1.5	34	15.45	7.82	-55	7.30	0.595	7/22/2010	1025	
BF-88	17.34	8.81	NP	NP	1030	18.28	9.36	-14	7.03	0.293	1040	1.5	18	17.68	4.17	-8.6	6.70	0.323	7/22/2010	1040	
BF-90	13.09	2.06	NP	NP	1045	20.31	1.2	-22.4	6.90	0.254	1055	1.5	23	22.01	1.01	-53.5	6.84	0.290	7/21/2010	1055	
BF-90D	damaged	NM	NP	NP	1025	15.31	3.81	1.6	7.64	0.569	1040	1.5	22.5	18.23	1.09	2	6.93	0.579	7/21/2010	1040	
BF-99	19.82	10.50	NP	NP	1105	18.55	8.15	-40	7.37	0.922	1125	1.5	20	15.89	6.52	-71.8	6.75	0.617	7/22/2010	1125	
RW-2	NM	11.32	11.16	0.16	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-1	12.09	2.41	NP	NP	1455	25.32	1.61	-37.6	7.50	1.267	1500	Hand	4.5	25.46	2.76	-58.6	7.26	1.263	7/21/2010	1500	
S-10	12.42	4.35	NP	NP	1255	24.39	1.51	-40.3	6.96	0.255	1300	1.5	4	16.78	3.05	-19.1	6.94	0.569	7/21/2010	1300	
S-11	8.17	3.17	NP	NP	1230	31.60	4.17	9.9	6.86	0.928	1235	1.5	8	25.78	1.34	-0.1	6.57	1.271	7/21/2010	1235	
S-113	NM	12.45	11.86	0.59	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-12	26.29	-	NP	NP	1215	32.13	6.07	14.6	7.27	0.940	1225	1.5	10.5	26.70	1.84	-4.7	7.00	0.761	7/21/2010	1225	
S-13	8.08	7.24	NP	NP	Blocked	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
S-14	9.52	3.03	NP	NP	0925	22.68	10.6	-44	9.19	0.927	935	1.5	14	25.26	0.52	-67.2	7.84	0.644	7/21/2010	0935	
S-16	37.84	22.45	NP	NP	1155	15.80	11.23	-8	6.58	1.025	1205	1.5	7.5	15.63	3.81	-30.7	6.30	1.025	7/16/2010	1205	
S-17	25.88	18.73	NP	NP	1115	16.81	2.33	19.3	7.03	1.485	1120	1.5	3.5	16.33	3.04	-5.4	6.63	1.463	7/16/2010	1120	
S-18	17.17	4.24	NP	NP	1220	18.88	7.68	8.7	6.38	2.628	1240	1.5	26	21.78	0.7	-23.3	6.39	2.667	7/16/2010	1240	
S-19	NM	6.05	6.03	0.02	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-2	12.42	8.36	NP	NP	1425	23.97	1.74	-3.6	6.77	1.866	1315	1.5	8	24.69	4.54	-3.8	6.71	2.092	7/21/2010	1430	
S-20	35.12	19.07	NP	NP	1310	16.19	10.45	59.4	7.37	0.745	1315	1.5	32	15.66	5.82	-5.6	7.11	0.711	7/16/2010	1315	
S-21	NM	10.55	10.49	0.06	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-22	80.68	19.20	NP	NP	1345	15.38	7.01	-13.9	7.45	0.457	1405	1.5	29.5	15.08	0.78	-35.2	6.91	0.589	7/16/2010	1405	
S-23	30.06	19.09	NP	NP	1045	14.22	2.22	-103.5	6.76	0.912	1100	1.5	21.5	14.40	2.36	-106.8	6.94	0.925	7/7/2010	1100	
S-24	18.21	2.57	NP	NP	Blocked	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	blocked	NS
S-25	20.15	13.71	NP	NP	Blocked	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	blocked	NS
S-3	14.89	7.17	NP	NP	1355	24.31	1.9	1.8	7.21	0.711	1400	Hand	4	24.12	4.08	-2	7.04	0.792	7/21/2010	1400	
S-5	8.28	2.99	2.98	0.01	1330	22.27	2.01	4	6.80	1.027	1340	1.5	9	22.77	0.6	-2.1	6.68	1.039	7/21/2010	1340	
S-59	NM	9.22	8.54	0.68	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-60	NM	12.05	11.33	0.72	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-66	26.73	-	NP	NP	Blocked	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	blocked	NS
S-69D	66.75	13.87	NP	NP	1600	17.31	14.1	13.6	6.94	0.873	1630	1.5	25	17.07	1.38	20.2	6.67	0.902	7/19/2010	1630	
S-8	62.24	TOC	NP	NP	1255	16.08	5.79	-40.9	7.01	0.125	1315	1.5	27	17.28	0.52	-44.9	6.87	0.205	7/21/2010	1315	
S-9	9.52	2.91	NP	NP	1245	21.35	7.22	13.2	6.64	1.013	1255	1.5	11	24.04	1.47	-5.3	6.34	0.967	7/21/2010	1255	
S-280	25.00	25.68	NP	NP	1300	16.01	2.76	-42.2	7.30	0.678	1330	Hand	2.5	17.03	2.72	-49.2	7.62	0.791	7/7/2010	1330	
S-280D	61.00	25.91	NP	NP	1350	17.11	4	-4.5	7.14	0.507	1415	1.5	68.5	17.42	0.34	-49.4	6.65	0.640	7/23/2010	1340	
S-281	25.00	13.11	NP	NP	1350	17.24	6.2	4.4	7.39	0.424	1410	1.5	22	17.20	3.57	20.9	6.63	0.519	7/15/2010	1410	
S-282	20.00	20.65	19.81	0.84	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-283	24.00	10.98	NP	NP	0935	18.11	11.94	-4.3	7.66	1.076	955	1.5	26.5	19.08	0.98	34.8	6.88	0.961	7/16/2010	0955	
S-284	20.00	6.30	NP	NP	1420	28.42	1.31	10.4	6.88	0.340	1440	1.5	26	27.94	0.97	-3.4	6.88	0.342	7/15/2010	1440	
S-284D	78.00	11.64	NP	NP	1315	16.35	6.17	-15.6	6.97	0.474	1340	1.5	129.5	16.02	2.28	-28.9	6.54	1.015	7/23/2010	1415	
S-285	20.00	14.53	13.94	0.59	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-290	20.00	10.19	NP	NP	1200	13.83	2.31	-85.9	6.88	2.339	1220	1.5	29	15.00	2.28	-90.4	7.03	2.174	7/7/2010	1220	
S-291	20.00	7.99	NP	NP	0920	24.67	0.99	-6.3	6.59	1.148	940	1.5	27.5	24.62	1.12	-63.8	6.92	1.181	7/7/2010	0940	

Notes:

- (1) - Measured prior to purging
- (2) - Wells purged with whale pump unless otherwise noted
- Groundwater quality readings collected using a YSI meter
- Blocked - Well was blocked, unable to lower pump
- A minimum of 3 well volumes were purged at each well location, unless well went dry during purging
- All wells were sampled using poly bailers
- Hand - Well purged using bailer
- ft btic - Feet below top of inner casing
- ft bgs - Feet below ground surface
- mg/L - Milligrams per Liter
- °C - Degrees celsius
- mV - Millivolts
- mS/cm - Millisiemens per centimeter
- NM - Not measured
- NP - No measurable product (>0.01 ft)
- NS-P - Not sampled due to measurable product (>0.01 ft)
- NS-Dry - Not sampled, well was dry
- gpm - Gallons per minute
- NM - Total depth of well not measured due to the presence of light non aqueous phase liquid (LNAPL)

APPENDIX F

Fate and Transport Analysis

APPENDIX F
FATE AND TRANSPORT MODELING PROCEDURES
AOI 3: SUNOCO PHILADELPHIA REFINERY
PHILADELPHIA, PENNSYLVANIA

QUICK DOMENICO MODELING

F.1 INTRODUCTION

Fate and transport calculations were completed for groundwater in Area of Interest (AOI) 3 to evaluate potential migration pathways/potential impacts to receptors. Seven shallow/intermediate wells (BF-106, S-16, S-20, S-23, S-280, S-281, and S-288) and two deep wells (BF-108 and S-22) in AOI 3 exhibited concentrations of groundwater compounds of concern (COCs) above their respective groundwater MSCs. The COCs that were above the MSCs in these wells were modeled using the analytical results from the July 2010 groundwater sampling event, and the Quick Domenico Version 2 (QD) spreadsheet model developed by Pennsylvania Department of Environmental Protection (PADEP). Site-specific data was used to complete the fate and transport calculations, when available.

F.2 MODEL OVERVIEW

The QD Model is a Microsoft Excel spreadsheet application based on the analytical contaminant transport equation developed by P.A. Domenico in *"An Analytical Model For Multidimensional Transport of a Decaying Contaminant Species,"* Journal of Hydrology, 91 (1987), pp. 49-58. The QD model calculates contaminant concentrations at any down-gradient location after a specified interval of time. The model incorporates the processes of advection, first order decay, retardation, and dispersion to describe fate and transport of compounds. In addition, the QD model displays the results as a two dimensional chart to facilitate interpretation of the results.

F.3 MODEL LIMITATIONS

Limitations of the QD model include:

- Groundwater flow is assumed to be steady state, and one-dimensional;
- Aquifer properties are assumed to be reasonably uniform;

- Applicable only to unconsolidated aquifers;
- Intended for use primarily with dissolved organic compounds;
- Does not account for the transformation of parent compounds into daughter products as the result of biodegradation;
- Compounds are considered individually, and are assumed to not react with each other; and
- The contaminant source is limited to a single and continuous source concentration.

F.4 MODEL INPUT PARAMETERS

In preparation of this report, input values for the QD model were compiled from available site-specific data. When no site-specific data was available, estimated input values from the PADEP spreadsheet "Number Please!," which is based on PA Code, Chapter 250, Appendix A, Table 5, or other acceptable literature sources, were utilized. The input parameters are discussed in detail in the following sections and are summarized in the input/output tables F.1 through F.9 in this appendix. An Excel spreadsheet interface was used to construct the QD simulations. This interface allowed the simulation of all relevant compounds at each well location to be constructed and saved in a single electronic file.

F.4.1 Source Concentration

Results of the July 2010 groundwater sampling indicated that five organic compounds (1, 2, 4-trimethylbenzene (TMB), 1, 3, 5-TMB, benzene, methyl tertiary butyl ether (MTBE), and toluene) were detected above their respective groundwater MSCs in shallow/intermediate monitoring wells (BF-106, S-16, S-20, S-23, S-280, S-281, and S-288). Groundwater sample results also indicated that two organic compounds (benzene and MTBE) were detected above their respective groundwater MSCs in deep monitoring wells (BF-108 and S-22). The potential for these compounds to migrate offsite was evaluated through the use of the QD model. Based on groundwater flow direction the concentrations in S-280 were evaluated in relation to AOI 3's western boundary (Schuylkill River) and the concentrations in BF-106, S-16, S-20, S-23, S-281, S-288, BF-108 and S-22 were evaluated in relation to AOI 3's eastern boundary (AOI 4).

F.4.2 Distance to Location of Concern (x)

Distance to the Location of Concern (distance) for the current simulations is the distance required for each COCs concentration to fall below its respective groundwater MSC under steady-state plume conditions. The distance is iteratively entered in the QD model until the location where the COC concentration reaches the MSC is identified. This step is performed using a large simulation time of 1×10^{99} days to ensure that the plume has reached steady-state.

F.4.3 Dispersivity

Dispersivity is the tendency of a dissolved plume to “spread out” as it moves down-gradient.

- Longitudinal dispersivity (A_x) occurs in the direction parallel to groundwater flow;
- Transverse dispersivity (A_y) occurs in the same plane as longitudinal dispersivity but perpendicular to the direction of groundwater flow; and
- Vertical dispersivity (A_z) occurs in the upward direction, normal to the plane in which longitudinal and transverse dispersivity occur (Vertical dispersivity is usually negligible and is typically omitted from most QD analyses).

Dispersivity estimates are difficult to quantify and are commonly estimated from the following relationships:

1. $A_x = X/10$ (where, X is the distance a contaminant has traveled by advective transport)
2. $A_y = A_x/10$
3. $A_z = A_x/20$ to $A_x/100$ (generally, it is recommended that A_z be a very small number (0.001) unless vertical monitoring can reliably justify a larger number. Additionally, a value of 0.0001 is suggested for uncalibrated or conceptual applications).

As stated above the value for A_y was estimated to be 10 percent of A_x . A value of 0.001 was used as a value for A_z .

F.4.4 Lambda

Lambda is the first order decay constant. It is determined by dividing 0.693 by the half-life of the compound. The value can typically be estimated for shrinking plumes by evaluating at concentrations versus time or distance. Lambda can also sometimes be estimated for stable plumes by evaluating concentration versus time using the methodology outlined in Buscheck and Alcantar (1995). Important considerations to estimating Lambda from site data include:

1. Are the measured concentrations along the centerline of the plume?
2. Are the measured concentrations the result of the single source area?
3. Are there no remedial systems and/or activities that effected the migration of the plume during the time interval of evaluation?

If the answer is yes to these questions, then the methodologies outlined in Buscheck and Alcantar may be utilized to estimate a site-specific lambda from site data.

Based on review of the available site data, the criteria necessary to calculate a site-specific lambda could not be met; therefore, a default value for lambda (when appropriate and available) was obtained from the PADEP spreadsheet "Number Please!" which is based on PA Code, Chapter 250, Appendix A, Table 5. The "Number Please!" spreadsheet does not include biodegradation rates for 1, 2, 4-TMB or 1, 3, 5-TMB. A brief internet search also did not produce any lambda estimates for 1, 2, 4-TMB or 1, 3, 5-TMB. Based on the previous modeling performed for the site, it was assumed that a representative lambda for these compounds would be very small, and therefore a value of 0.01 year^{-1} ($2.74 \times 10^{-5} \text{ day}^{-1}$) was used.

F.4.5 Source Dimensions

Source width is the maximum width of the area measured perpendicular to the direction of groundwater flow. Source thickness is the thickness of the contaminated soils below the water table that contribute contamination to groundwater. In addition to the saturated zone, fluctuation in groundwater elevation may create a smear zone in the unsaturated portion of an aquifer. As an estimate of the thickness of the smear zone, average fluctuation can be used. Since no plumes have been delineated, a source width of 100 ft was used. The source thicknesses used was 15 feet (ft), which is the average thickness of the upper unconfined aquifer.

F.4.6 Hydraulic Conductivity (k)

The hydraulic conductivity of a geologic material is a measure of its ability to transmit water. A hydraulic conductivity of 24 ft/d was used in the AOI 3 QD simulations. This value is the hydraulic conductivity of the Trenton gravel at the site, obtained from the recovery data recorded at RW-406 (located in AOI 1). This value is representative of the geometric mean of hydraulic conductivity values calculated using aquifer testing recovery data in Well RW-406 by SECOR in 2003 (SECOR, 2003), and appears to be most representative of the Trenton Gravel. Since the composition of the Trenton Gravel in AOI 3 was consistent with AOI 1, this value of hydraulic conductivity was chosen as representative for conditions in AOI 3.

F.4.7 Hydraulic Gradient

Hydraulic gradient is the change in hydraulic head relative to the distance between head measurement locations. The hydraulic gradient is measured parallel to the direction of ground water flow assuming horizontal flow and a uniform gradient. The average value of the hydraulic gradient in the fill/alluvium and Trenton Gravel ranged from 0.0001 to 0.0091 with an average of 0.003. Groundwater flow in the Lower Sand is uniformly to the east, southeast. A hydraulic gradient of .00126 was used for the well screened in the Lower Sand, as measured between BF-108/S-69D from the July 2010 gauging event. Using the groundwater elevations collected in July 2010, the hydraulic gradient values used in the QD simulations were estimated between the well with the concentration exceeding the MSC and its nearest downgradient well.

F.4.8 Porosity (n)

Porosity is measured as the ratio of the volume of void space in a geologic material to the total volume of material. Porosity values used in the fate and transport modeling for AOI 3 were based on historical geotechnical analysis.

F.4.9 Soil Bulk Density (ρ_b)

Soil bulk density is the dry weight of a sample divided by the total volume of the sample in an undisturbed state. Soil bulk density can either be determined by a laboratory or by the equation

$$\rho_b = 2.65 * (1 - n).$$

Soil bulk density values used in the fate and transport modeling were based on historical geotechnical analysis.

F.4.10 Organic Carbon Partition Coefficient (KOC)

The organic carbon partition coefficient is chemical specific and is provided in the PADEP EP spreadsheet "Number Please!" which is based on PA Code, Chapter 250, Appendix A, Table 5. These values were used in the fate and transport modeling.

F.4.11 Fraction Organic Carbon (foc)

The fraction of organic carbon is the organic carbon content of a soil. A laboratory using ASTM methods can determine this value. Samples for organic carbon are taken from the same soil horizon in which the contaminant occurs, but outside of the impacted area. Since no site specific fraction of organic carbon data was available for the site, the fate and transport modeling used the model-recommended default concentration of 0.005, which is a conservative value based on the description of site soils.

F.4.12 Plume Coordinates ('y' and 'z')

The plume coordinates, 'y' and 'z,' define the horizontal and vertical extent of the impacted area, respectfully. For a solution on the centerline of the plume down gradient from the source, 'y' was set equal to zero. Additionally, to yield the highest concentration, which is located at the water table, 'z' was also set equal to zero.

F.4.13 Time (t)

'Time zero' is the point at which contamination was introduced into the aquifer. Time since 'time zero' is measured in days. The final simulation time of 1×10^{99} days was used to ensure that a steady-state plume was simulated.

F.4.14 Grid Dimensions

The grid dimensions form the window through which the plume is viewed and the locations where concentrations are calculated. The grid is determined by user specified length and width measurements from the source of the plume.

F.5 OUTPUT DATA AND RESULTS

A spreadsheet for each well for which a QD simulation was performed and is included at the end of this appendix. The QD simulations prepared for the shallow/intermediate (fill/alluvium and Trenton Gravel) are summarized in Tables F.1 through F.7 and for deep wells in Tables F.8 and F.9. The results of the QD screening can be found in Table F.11. A comparison between the model-predicted downgradient transport distance and the distance to the nearest property boundary and/or surface water receptor is also included in these tables. The following summaries the results of the QD simulations:

- The modeling results indicate that concentrations above the MSC in shallow/intermediate wells BF-106, S-16, S-20, S-23, S-281, S-288, S-280, and in deep wells BF-108 and S-22 are not predicted to migrate beyond the AOI 3 boundary.
- The modeling results indicate that two monitoring wells (S-281 and S-288) contain concentrations of VOCs (1,2,4-TMB and 1,3,5-TMB in S-281 and benzene in S-288) that have the potential to reach the AOI-3 boundary and migrate into AOI 4. Based on the QD simulations, groundwater concentrations in exceedance of the MSC will not reach the Refinery boundary, located along the eastern boundary of AOI 4.
- The modeling results for benzene in S-280 were predicted not to attenuate to a concentration below its groundwater MSC by the time it reaches the AOI 3 western boundary (Schuylkill River). The QD model predicts the benzene concentration adjacent to the Schuylkill River (285 feet away from S-280) to be 315 ug/L (Table F.10) which is below the benzene acute fish criterion of 640 ug/L, but above the chronic fish criterion of 130 ug/L. Therefore, a surface water screening concentration (waste load allocation) for benzene was calculated for S-280 using the PENTOXSD modeling, and is presented in the next section.

F.6 PENTOX Evaluation

The Pennsylvania Single Discharge Waste load Allocation Program for Toxics Version 2.0 (PENTOX) was used to calculate site-specific, groundwater screening concentrations (also called wasteload allocations) protective of surface water. Waste load allocations generated through PENTOX take into account the dilution of groundwater as it diffuses into flowing surface water and represent the groundwater concentration at which the Pennsylvania Code Chapter 93 Water Quality Criteria (WQC) for Toxic Substances (PA WQC) has the potential to be exceeded. As a result of the QD screening of benzene at S-280 it was predicted that concentrations would not attenuate below the groundwater MSC before reaching the nearest surface water body. PENTOX was then used to assess the potential impact of benzene on the Schuylkill River.

F.7 PENTOX Input Data

PENTOX model input values were derived from reports by Langan, previous consultants and government agencies. The variables used in PENTOX to model groundwater discharge to the Schuylkill River are summarized in Table F.10 along with their source(s).

7.1 Compound of Interest

Benzene was detected in S-280 at a concentration of 41,000 ug/L during the July 2010 groundwater sampling event. This concentration exceeds the PADEP Non-Residential Groundwater screening value of 5 ug/L. Because groundwater near S-280 has the potential to discharge to the Schuylkill River the effect on surface water quality standards must be addressed. For benzene the PA GWQ continuous (chronic) and maximum (acute) fish and aquatic life criteria are 130 ug/L and 640 ug/L respectively. The predicted concentration at the Schuylkill River for benzene is 315 ug/L which does not exceed the acute but does exceed the chronic surface water criteria. Therefore PENTOX was used to generate a groundwater to surface water screening criteria to evaluate the groundwater concentration of benzene.

7.2 Aquifer Parameters and Groundwater Flux

Aquifer parameters were entered into the groundwater flow equation to calculate the volumetric aquifer discharge to the Schuylkill River (Table F.10). The hydraulic conductivity, hydraulic gradient and cross sectional area was taken directly from the S-280 Quick Domenico simulation (Table F.5).

7.3 Stream Parameters

Stream parameters were selected to represent the discharge point and the confluence of the Schuylkill River with the Delaware River. Stream parameters were derived from USGS topographic maps (river mile index and river width). River low flow conditions (ten-year – consecutive seven-day low-flow (Q_{7-10})) were accessed on the Low-Flow Statistics for Pennsylvania Streams developed by the USGS and PADEP. The gauging stations used are located at the Penrose Avenue and Chestnut Street bridges. Drainage areas for the AOI-3 point of discharge and river confluence are from the same USGS/PADEP website. Since the estimated point of discharge to surface water in AOI-3 lies between the two gauging stations the average flow conditions and drainage area were used. River stage at the potential discharge point in AOI-3 and at the confluence of the Schuylkill and Delaware Rivers were drawn from Schreffler, 2001. All other parameters required by PENTOX such as flow at the confluence of the Schuylkill and Delaware Rivers as well as their depths at those locations were calculated by PENTOX. Stream parameter input values are summarized in Table F.10.

F.8 PENTOX Model Results

The PENTOXSD derived a groundwater to surface water screening standard (waste load allocation) for benzene of 1,415 ug/L. The predicted concentration for benzene at the Schuylkill River is 315 ug/L (concentration at S-280 is 41,000 ug/L), which is below the calculated surface water screening concentration, and therefore benzene in groundwater at S-280 does not pose a significant risk to surface water quality in the Schuylkill River.

PENTOXSD input and output files are presented in Tables F.10 through F.15.

Table F.1
Quick Domenico
Fate and Transport Model Input and Output
AOI-3 Shallow Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Project
 Prepared by
 Date Prepared

2574601 - Sunoco Philadelphia Refinery
 Terrance Stanley
 9/8/2010

Generic Input Parameters				Data Source
Source Identification (or Well ID)			BF-106	
Sample Date			7/22/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	y	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivity	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.00015	BF-106/BF-105 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	p _b	g/cm ³	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			1,2,4-Trimethylbenzene	
Source Concentration (mg/L)		mg/L	0.1300	July 2010 Sampling
Lambda (per day)		day ⁻¹	2.740E-05	PA DEP Number Please! Spreadsheet
KOC			2200	PA DEP Number Please! Spreadsheet
Sim 2				
Contaminant			Benzene	
Source Concentration (mg/L)		mg/L	0.1300	July 2010 Sampling
Lambda (per day)		day ⁻¹	9.5890E-04	PA DEP Number Please! Spreadsheet
KOC			58	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - 1,2,4-Trimethylbenzene	0.1300	0.035	0.035	29
Sim 2 - Benzene	0.1300	0.005	0.005	56

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.2
Quick Domenico
Fate and Transport Model Input and Output
AOI-3 Shallow Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Project
 Prepared by
 Date Prepared

2574601 - Sunoco Philadelphia Refinery
 Terrance Stanley
 9/8/2010

Generic Input Parameters				Data Source
Source Identification (or Well ID)			S-16	
Sample Date			7/16/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	y	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivity	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.0001	S-17/S-16 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	p _b	g/cm ³	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			1,2,4-Trimethylbenzene	
Source Concentration (mg/L)		mg/L	0.4000	July 2010 Sampling
Lambda (per day)		day ⁻¹	2.740E-05	PA DEP Number Please! Spreadsheet
KOC			2200	PA DEP Number Please! Spreadsheet
Sim 2				
Contaminant			1,3,5-Trimethylbenzene	
Source Concentration (mg/L)		mg/L	0.1400	July 2010 Sampling
Lambda (per day)		day ⁻¹	2.7397E-05	PA DEP Number Please! Spreadsheet
KOC			660	PA DEP Number Please! Spreadsheet
Sim 3				
Contaminant			Benzene	
Source Concentration (mg/L)		mg/L	0.2200	July 2010 Sampling
Lambda (per day)		day ⁻¹	0.001	PA DEP Number Please! Spreadsheet
KOC			58	PA DEP Number Please! Spreadsheet
Sim 4				
Contaminant			MTBE	
Source Concentration (mg/L)		mg/L	0.0400	July 2010 Sampling
Lambda (per day)		day ⁻¹	0.002	PA DEP Number Please! Spreadsheet
KOC			12	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - 1,2,4-Trimethylbenzene	0.4000	0.035	0.035	42
Sim 2 - 1,3,5-Trimethylbenzene	0.1400	0.035	0.035	48
Sim 3 - Benzene	0.2200	0.005	0.005	52
Sim 4 - MTBE	0.0400	0.020	0.020	9

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

**Table F.3
Quick Domenico
Fate and Transport Model Input and Output
AOI-3 Shallow Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania**

Project
Prepared by
Date Prepared

2574601 - Sunoco Philadelphia Refinery
Terrance Stanley
9/8/2010

Generic Input Parameters				Data Source
Source Identification (or Well ID)			S-20	
Sample Date			7/16/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	y	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivity	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.00015	S-16/S-20 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	p _b	g/cm ³	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			MTBE	
Source Concentration (mg/L)		mg/L	0.0970	July 2010 Sampling
Lambda (per day)		day ⁻¹	1.899E-03	PA DEP Number Please! Spreadsheet
KOC			12	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - MTBE	0.0970	0.020	0.020	26

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

**Table F.4
Quick Domenico
Fate and Transport Model Input and Output
AOI-3 Shallow Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania**

Project
Prepared by
Date Prepared

2574601 - Sunoco Philadelphia Refinery
Terrance Stanley
9/8/2010

Generic Input Parameters				Data Source
Source Identification (or Well ID)			S-23	
Sample Date			7/7/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	y	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivity	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.00029	S-23/S-25 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	p _b	g/cm ³	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			1,2,4-Trimethylbenzene	
Source Concentration (mg/L)		mg/L	0.0510	July 2010 Sampling
Lambda (per day)		day ⁻¹	2.740E-05	PA DEP Number Please! Spreadsheet
KOC			2200	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - 1,2,4-Trimethylbenzene	0.0510	0.035	0.035	12

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

**Table F.5
Quick Domenico
Fate and Transport Model Input and Output
AOI-3 Shallow Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania**

Project
Prepared by
Date Prepared

2574601 - Sunoco Philadelphia Refinery
Terrance Stanley
9/8/2010

Generic Input Parameters				Data Source
Source Identification (or Well ID)			S-280	
Sample Date			7/7/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	y	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivity	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.0012	S-280 July 2010/River Stage (0.6 ft)
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	p _b	g/cm ³	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Benzene	
Source Concentration (mg/L)		mg/L	41.0000	July 2010 Sampling
Lambda (per day)		day ⁻¹	9.589E-04	PA DEP Number Please! Spreadsheet
KOC			58	PA DEP Number Please! Spreadsheet
Sim 2				
Contaminant			Toluene	
Source Concentration (mg/L)		mg/L	6.9000	July 2010 Sampling
Lambda (per day)		day ⁻¹	2.4685E-02	PA DEP Number Please! Spreadsheet
KOC			130	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - Benzene	41.0000	0.005	0.005	540
Sim 2 - Toluene	6.9000	1.000	1.000	13

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.6
Quick Domenico
Fate and Transport Model Input and Output
AOI-3 Shallow Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Project
 Prepared by
 Date Prepared

2574601 - Sunoco Philadelphia Refinery
 Terrance Stanley
 9/8/2010

Generic Input Parameters				Data Source
Source Identification (or Well ID)			S-281	
Sample Date			7/15/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	y	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivity	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.0046	S-281/S-60 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	p _b	g/cm ³	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			1,2,4-Trimethylbenzene	
Source Concentration (mg/L)		mg/L	1.2000	July 2010 Sampling
Lambda (per day)		day ⁻¹	2.740E-05	PA DEP Number Please! Spreadsheet
KOC			2200	PA DEP Number Please! Spreadsheet
Sim 2				
Contaminant			1,3,5-Trimethylbenzene	
Source Concentration (mg/L)		mg/L	0.5200	July 2010 Sampling
Lambda (per day)		day ⁻¹	2.7397E-05	PA DEP Number Please! Spreadsheet
KOC			660	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - 1,2,4-Trimethylbenzene	1.2000	0.035	0.035	690
Sim 2 - 1,3,5-Trimethylbenzene	0.5200	0.035	0.035	1,180

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

**Table F.7
Quick Domenico
Fate and Transport Model Input and Output
AOI-3 Shallow Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania**

Project
Prepared by
Date Prepared

2574601 - Sunoco Philadelphia Refinery
Terrance Stanley
9/8/2010

Generic Input Parameters				Data Source
Source Identification (or Well ID)			S-288	
Sample Date			7/22/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	y	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivity	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.0091	BF-104/S-288 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	p _b	g/cm ³	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			1,2,4-Trimethylbenzene	
Source Concentration (mg/L)		mg/L	0.0470	July 2010 Sampling
Lambda (per day)		day ⁻¹	2.740E-05	PA DEP Number Please! Spreadsheet
KOC			2200	PA DEP Number Please! Spreadsheet
Sim 2				
Contaminant			Benzene	
Source Concentration (mg/L)		mg/L	0.2800	July 2010 Sampling
Lambda (per day)		day ⁻¹	9.5890E-04	PA DEP Number Please! Spreadsheet
KOC			58	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - 1,2,4-Trimethylbenzene	0.0470	0.035	0.035	90
Sim 2 - Benzene	0.2800	0.005	0.005	960

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

**Table F.8
Quick Domenico
Fate and Transport Model Input and Output
AOI-3 Deep (Lower Sand) Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania**

Project
Prepared by
Date Prepared

2574601 - Sunoco Philadelphia Refinery
Terrance Stanley
9/8/2010

Generic Input Parameters				Data Source
Source Identification (or Well ID)			BF-108	
Sample Date			7/22/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	25	Estimated from USGS Cross-section B-B'
Perpendicular Distance to Location of Concern	y	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivity	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.00043	BF-108/S-69D July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	p _b	g/cm ³	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			MTBE	
Source Concentration (mg/L)		mg/L	0.1200	July 2010 Sampling
Lambda (per day)		day ⁻¹	1.899E-03	PA DEP Number Please! Spreadsheet
KOC			12	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - MTBE	0.1200	0.020	0.020	55

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

**Table F.9
Quick Domenico
Fate and Transport Model Input and Output
AOI-3 Deep (Lower Sand) Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania**

Project
Prepared by
Date Prepared

2574601 - Sunoco Philadelphia Refinery
Terrance Stanley
9/8/2010

Generic Input Parameters				Data Source
Source Identification (or Well ID)			S-22	
Sample Date			7/16/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	25	Estimated from USGS cross-section B-B'
Perpendicular Distance to Location of Concern	y	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivity	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.00054	S-22/BF-108 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	p _b	g/cm ³	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Benzene	
Source Concentration (mg/L)		mg/L	0.0060	July 2010 Sampling
Lambda (per day)		day ⁻¹	9.589E-04	PA DEP Number Please! Spreadsheet
KOC			58	PA DEP Number Please! Spreadsheet
Sim 2				
Contaminant			MTBE	
Source Concentration (mg/L)		mg/L	0.0480	July 2010 Sampling
Lambda (per day)		day ⁻¹	1.8986E-03	PA DEP Number Please! Spreadsheet
KOC			12	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - Benzene	0.0060	0.005	0.005	7
Sim 2 - MTBE	0.0480	0.020	0.020	31

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.10
Quick Domenico
S-280 Forward Simulation for Benzene
AOI-3 Shallow Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Project
 Prepared by
 Date Prepared

2574601 - Sunoco Philadelphia Refinery
 Terrance Stanley
 9/8/2010

Generic Input Parameters				Data Source
Source Identification (or Well ID)			S-280	
Sample Date			7/7/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	y	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivity	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.0012	S-280 July 2010/River Stage (0.6 ft)
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	p _b	g/cm ³	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Benzene	
Source Concentration (mg/L)		mg/L	41.0	July 2010 Sampling
Lambda (per day)		day ⁻¹	9.589E-04	PA DEP Number Please! Spreadsheet
KOC			58	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Distance from S-280 to the Schuylkill River (Rounded to the Nearest foot)
Sim 1 - Benzene	41.0000	0.005	0.315	285

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.11
Fate and Transport Screening Results for Groundwater
Predicted Distance to Achieve Groundwater Screening Standard
AOI-3
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Chemical Name	Location	BF-106	S-16	S-20	S-23	S-280	S-281	S-288	BF-108	S-22
	Sample ID	BF-106_072210	S-16_071610	S-20_071610	S-23_070710	S-280_070710	S-281_071510	S-288_072210	BF-108_072210	S-22_071610
	Sample Date	7/22/2010	7/16/2010	7/16/2010	7/7/2010	7/7/2010	7/15/2010	7/22/2010	7/22/2010	7/16/2010
	Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds	Units	Result	Result	Result	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	ft	29	42	--	12	--	690	90	--	--
1,3,5-TRIMETHYLBENZENE	ft	--	48	--	--	--	1,180	--	--	--
BENZENE	ft	56	52	--	--	540	--	960	--	7
TERT-BUTYL METHYL ETHER	ft	--	9	26	--	--	--	--	55	31
TOLUENE	ft	--	--	--	--	13	--	--	--	--

Notes:

PADEP - Pennsylvania Department of Environmental Protection

-- = Detected concentration (if any) is below PADEP MSC for groundwater therefore it was not included in the Quick Domenico analysis.

All predicted distances rounded to the nearest foot.

26 = Predicted distance to attenuate to PADEP MSC is greater than distance to Schuylkill River.

26 = Predicted distance to attenuate to PADEP MSC is greater than distance to AOI 3 boundary.

Table F.12
S-280 PENTOXSD Input Data
AOI 3 Shallow Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Parameter	Unit	Value	Source
River Mile Index (at discharge point)	mile	2.8	USGS Philadelphia Quadrangle Map
River Stage Elevation (at discharge point)	ft	1.0	Water-Resources Investigations Report 01-4218 ⁽¹⁾
Drainage Area	mi ²	1,905.00	Pennsylvania Gazetteer of Streams PADEP/USGS
Q ₇₋₁₀ Stream Flow	ft ³ /s	101.5	USGS-PADEP Low-Flow Statistics Website.
Q ₇₋₁₀ Reach Width	ft	530	USGS Philadelphia Quadrangle Map
Q ₇₋₁₀ Reach Depth	ft	Calculated by PENTOX	Calculated by PENTOX
Q _h Stream Flow	ft ³ /s	809.00	USGS-PADEP Low-Flow Statistics Website.
Q _h Reach Width	ft	530.00	USGS Philadelphia Quadrangle Map
Q _h Reach Depth	ft	Calculated by PENTOX	Calculated by PENTOX
River Mile Index (at confluence)	mile	0.001	USGS Philadelphia Quadrangle Map
River Stage Elevation (at confluence)	ft	0.50	Water-Resources Investigations Report 01-4218 ⁽¹⁾
Drainage Area	mi ²	1,912.00	Pennsylvania Gazetteer of Streams PADEP/USGS
Q ₇₋₁₀ Stream Flow	ft ³ /s	Calculated by PENTOX	NA
Q ₇₋₁₀ Reach Width	ft	1,050.00	USGS Philadelphia Quadrangle Map
Q ₇₋₁₀ Reach Depth	ft	Calculated by PENTOX	NA
Q _h Stream Flow	ft ³ /s	Calculated by PENTOX	NA
Q _h Reach Width	ft	1,050.00	USGS Philadelphia Quadrangle Map
Q _h Reach Depth	ft	Calculated by PENTOX	NA
Diffuse Groundwater Flow	million gallons per day	0.0003	Calculated
Hydraulic Conductivity (K)	ft/d	24.0	S-280 Quick Domenico Simulation (In this Appendix)
Hydraulic Gradient (i)	ft/ft	0.00120	S-280 Quick Domenico Simulation (In this Appendix)
Area of groundwater flux (A)	ft ²	1,500.00	S-280 Quick Domenico Simulation (In this Appendix)

NOTES:

NA = Not Applicable.

(1) Simulation of Ground-Water Flow in the Potomac-Raritan-Magothy Aquifer System Near the Defense Supply Center Philadelphia, and the Point Breeze Refinery, Southern Philadelphia County, Pennsylvania.

Table F.13 PENTOXSD

Modeling Input Data

Stream Code	RMI	Elevation (ft)	Drainage Area (sq mi)	Slope	PWS With (mgd)	Apply FC
18633	2.75	1.00	1905.00	0.00000	0.00	<input checked="" type="checkbox"/>

Stream Data

LFY	Trib Flow	Stream Flow	WD Ratio	Rch Width	Rch Depth	Rch Velocity	Rch Trav Time	Tributary		Stream		Analysis		
								Hard	pH	Hard	pH	Hard	pH	
(cfsm)	(cfs)	(cfs)		(ft)	(ft)	(fps)	(days)	(mg/L)		(mg/L)		(mg/L)		
Q7-10	0.1	0	101.5	0	530	0	0	0	100	7	0	0	0	0
Qh		0	809	0	530	0	0	0	100	7	0	0	0	0

Discharge Data

Name	Permit Number	Existing Disc Flow	Permitted Disc Flow	Design Disc Flow	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard	Disc pH
										(mg/L)	
AOI-3 S-280	2574601	0.00032	0	0	0	0	0	0	0	100	7

Parameter Data

Parameter Name	Disc Conc	Trib Conc	Disc Daily CV	Disc Hourly CV	Steam Conc	Stream CV	Fate Coef	FOS	Crit Mod	Max Disc Conc
										(µg/L)
BENZENE	41000	0	0.5	0.5	0	0	0	0	1	0

Stream Code	RMI	Elevation (ft)	Drainage Area (sq mi)	Slope	PWS With (mgd)	Apply FC
18633	0.00	0.50	1912.00	0.00000	0.00	<input checked="" type="checkbox"/>

Stream Data

LFY	Trib Flow	Stream Flow	WD Ratio	Rch Width	Rch Depth	Rch Velocity	Rch Trav Time	Tributary		Stream		Analysis		
								Hard	pH	Hard	pH	Hard	pH	
(cfsm)	(cfs)	(cfs)		(ft)	(ft)	(fps)	(days)	(mg/L)		(mg/L)		(mg/L)		
Q7-10	0.1	0	0	0	1050	0	0	0	100	7	0	0	0	0
Qh		0	0	0	1050	0	0	0	100	7	0	0	0	0

Discharge Data

Name	Permit Number	Existing Disc Flow	Permitted Disc Flow	Design Disc Flow	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard	Disc pH
										(mg/L)	
		0	0	0	0	0	0	0	0	100	7

Parameter Data

Parameter Name	Disc Conc	Trib Conc	Disc Daily CV	Disc Hourly CV	Steam Conc	Stream CV	Fate Coef	FOS	Crit Mod	Max Disc Conc
										(µg/L)
BENZENE	0	0	0.5	0.5	0	0	0	0	1	0

Table F.14 PENTOXSD Analysis Results

Hydrodynamics

<u>SWP Basin</u>		<u>Stream Code:</u>			<u>Stream Name:</u>						
06B		18633			BENNYS RUN						
RMI	Stream Flow (cfs)	PWS With (cfs)	Net Stream Flow (cfs)	Disc Analysis Flow (cfs)	Reach Slope	Depth (ft)	Width (ft)	WD Ratio	Velocity (fps)	Reach Trav Time (days)	CMT (min)

Q7-10 Hydrodynamics

2.750	101.5	0	101.5	0.00049	3.4E-05	0.49012	530	1081.37	0.39074	0.42994	1000+
0.001	102.2	0	102.2	NA	0	0	0	0	0	0	NA

Qh Hydrodynamics

2.750	809	0	809	0.00049	3.4E-05	1.22166	530	433.835	1.24946	0.13445	1000+
0.001	811.539	0	811.539	NA	0	0	0	0	0	0	NA

Table F.15 PENTOXSD Analysis Results

Wasteload Allocations

RMI	Name	Permit Number							
2.75	AOI-3 S-280	2574601							
AFC									
Q7-10:	CCT (min)	15	PMF	0.008	Analysis pH	7	Analysis Hardness	100	
	Parameter		Stream Conc (µg/L)	Stream CV	Trib Conc (µg/L)	Fate Coef	WQC (µg/L)	WQ Obj (µg/L)	WLA (µg/L)
	BENZENE		0	0	0	0	640	640	1150000
CFC									
Q7-10:	CCT (min)	720	PMF	0.061	Analysis pH	7	Analysis Hardness	100	
	Parameter		Stream Conc (µg/L)	Stream CV	Trib Conc (µg/L)	Fate Coef	WQC (µg/L)	WQ Obj (µg/L)	WLA (µg/L)
	BENZENE		0	0	0	0	130	130	1620000
THH									
Q7-10:	CCT (min)	720	PMF	NA	Analysis pH	NA	Analysis Hardness	NA	
	Parameter		Stream Conc (µg/L)	Stream CV	Trib Conc (µg/L)	Fate Coef	WQC (µg/L)	WQ Obj (µg/L)	WLA (µg/L)
	BENZENE		0	0	0	0	NA	NA	NA
CRL									
Qh:	CCT (min)	720	PMF	0.121					
	Parameter		Stream Conc (µg/L)	Stream CV	Trib Conc (µg/L)	Fate Coef	WQC (µg/L)	WQ Obj (µg/L)	WLA (µg/L)
	BENZENE		0	0	0	0	1.2	1.2	237255.5

APPENDIX G

Development of Site-Specific Standards and Risk Assessment

APPENDIX G
DEVELOPMENT OF SITE-SPECIFIC STANDARDS
AOI 3: SUNOCO PHILADELPHIA REFINERY
PHILADELPHIA, PENNSYLVANIA

Based on the current and future intended non-residential site use, an exposure assessment was conducted for all compounds in surficial soil which exceeded the non-residential statewide health standards in AOI 3. Potential human health exposures for the Refinery are for an industrial worker scenario..

Direct contact exposure pathways to surface soil, groundwater, and LNAPL is for the industrial scenario because of Sunoco's established excavation procedures, PPE requirements and soil handling procedures, as they are described in Appendix K of the 2004 Current Conditions Report (CCR). However, because direct contact to surface soils could occur outside of excavation activities, shallow soil samples were collected in AOI 3 to further evaluate this pathway under a non-residential (on-site worker) scenario.

Based on the recent characterization data collected, concentrations of benzene and lead were detected above the non-residential soil MSCs in surficial soil (0-2 feet). In accordance with Section IV of the PADEP's Technical Guidance Manual (TGM) (dated June 8, 2002), to reduce the list of compounds carried through the risk assessment, the COCs listed above were further screened against the EPA Region III Risk-Based Concentrations RBCs (aka, EPA Regional Screening Levels) for industrial soil; however, from the above listed compounds, only lead also exceeded the Region III's RBCs.

For both compounds that exceed both the non-residential statewide health standards, site-specific standards were calculated using PADEP default intake parameters for an on-site worker and, where appropriate, a risk level of 10^{-4} . For calculating a site-specific standard for on-site workers exposed to lead, Sunoco used the Society of Environmental Geochemistry and Health (SEGH) model used by PADEP to develop the non-residential MSC. The input parameters used to develop the site-specific standards for benzene and lead are provided in Tables G-1 and G-2, respectively.

The site-specific standards calculated for benzene and lead (in Tables G-1 and G-2, respectively) are as follows:

Compound	Calculated Site-Specific Standard (mg/kg)
Benzene	2,160
Lead	3,140

The site-specific screening level for benzene was calculated for inhalation, based on the calculations specified in 25 Pa. Code § 250.306(b)(1). Based on these calculations and PADEP's default parameters, PADEP's non-residential direct contact MSC default value for benzene in surface soil is 21,522 mg/kg. To develop a site-specific criteria for benzene, the target risk level used by the PADEP was updated in consideration of site-specific conditions, from 1E-5 to 1E-4. As presented in Table G-1, based on the revised target risk level, the derived site-specific standard for benzene in soil is 2,160 mg/kg (rounded) for an onsite worker, and is consistent with the values used in the previous SCR/RIR prepared for AOIs 1, 4, 6, 5, 8 and 9.

Concentrations of benzene detected in the surface soil samples collected in AOI 3 are below the site-specific standards and, therefore, risk to an on-site worker due to exposure is considered to be within the acceptable ACT 2 range.

The site-specific screening level for lead was calculated for ingestion. As presented in 25 Pa. Code § 250.306(e), Appendix A, Table 7, the non-residential soil screening value for lead is based on the method presented in the report 'The Society for Environmental Geochemistry and Health (SEGH) Task Force Approach to the Assessment of Lead in Soil' (Wixson, 1991). The model used by the PADEP and developed by SEGH was also used to calculate the site specific criterion for the refinery. Based on the SEGH model and PADEP's default parameters, PADEP's non-residential direct contact MSC default value for lead in surface soil is 1,000 mg/kg. To develop a site-specific criteria for lead, some of the parameters used by the PADEP were updated in consideration of site-

specific conditions and updated lead data collected from recent studies. These parameters are discussed in the following paragraphs.

Target blood lead concentration (T) – The default target blood lead concentration used by the PADEP to develop the non-residential MSC is 20 ug/dL; however, the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) recommends that worker blood lead levels be maintained below 40 ug/dL (OSHA, 29 CFR 1910.1025) to prevent adverse health effects for most workers from exposure to lead throughout a working lifetime. To minimize adverse reproductive health effects, OSHA further recommends that the blood lead levels of workers (both male and female) who intend to have children should be maintained below 30 ug/dL. Based on the action levels provided by OSHA the value used for T in the site specific calculation has been revised to 30 ug/dL.

Geometric mean background blood lead concentration (B) – B is the background blood lead concentration in the target population from sources other than soil and dust. The PADEP's default value for B is 4 ug/dL and, as summarized in PADEPs reference document (Wixson, 1991), is based on data gathered in the United Kingdom from young children. The US Center for Disease Control and Prevention (CDC) in Atlanta, GA has monitored blood lead levels in US children and adults since 1976 and, based on the most recent results published by the National Center for Environmental Health of the CDC (NCEH, 2005), the mean blood lead concentration for an adult 20 years of age or older is 1.56 ug/dL. Based on the more recent study by the US CDC, the value used for B in the site specific calculation has been revised to 1.56 ug/dL.

Slope of blood lead to soil lead (δ) – The PADEP's default value for δ is 7.5 ug/dL blood per ug/g soil; however, based on recommendations by the United Kingdom's Department for Environment, Food, and Rural Affairs (DEFRA, 2002) the reasonable range of δ values is between 2 and 5 ug/dL blood per ug/g soil and should be selected based on site-specific information. Based on the

DEFRA's guidance, low values of δ relate primarily to groups of older children, well maintained (dense) vegetative cover, low bioavailability, heavier textured soils, and good personal grooming habits. Higher values of δ tend to be found in groups of children between the ages of 18 and 24 months, sparse vegetation, soluble lead salts, light textured or soils with low organic matter, and poor personal grooming habits. Based on the suggested range for δ by the DEFRA and because access to the refinery is restricted and PPE is required we believe a value of 7.5 ug/dL is too conservative. Because the soils at the refinery are sandy with low organic matter we selected the highest value within the range suggested by the SEGH, 5.0 ug/dL.

As presented in Table G-2, based on the revised parameters, the derived site-specific standard for lead in soil is 3,140 mg/kg for a refinery worker, and is consistent with the value calculated in the SCR/RIR prepared for AOI 9. Concentrations of lead detected in the surface soil samples collected in AOI 3 are below the site-specific standard, with the exception of one sample (BH-10-02_1-2). With the exception to this sample, risk to an on-site worker due to exposure is considered minimal. Potential lead exposure within the areas of BH-10-02_1-2 will be addressed by Sunoco through implementation of a remedy which will either remediate the lead concentration in shallow soil or eliminate the potential pathway to on-site workers.

In addition to calculating the site-specific standards for benzene and lead, the cumulative risk of exposure was also calculated. Lead exposure is dependent on the blood/lead concentration and not risk based; therefore, lead could not be incorporated into the cumulative risk calculation.

The cumulative hazard index is the combined index for exposure to non-carcinogenic compounds, and it cannot exceed 1. For AOI 3 none of the non-carcinogenic compounds exceeded the state-wide health standard and, therefore, a cumulative hazard index was not calculated.

The total cumulative risk is the combined risk of exposure to the concentrations of carcinogenic compounds which for AOI 3 is benzene. In accordance with the TGM, the total cumulative risk cannot exceed 10^{-4} . As presented in Table G-3, the total cumulative risk of exposure to the carcinogenic compounds in AOI 3 is $5.30E-08$, and therefore, no remedies are required for AOI 3 to address direct contact to benzene.

References

DEFRA. (2002). Soil Guideline Values for Lead Contamination. Bristol, UK: R&D Publication SGV 10 Environment Agency.

NCEH. (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, National Center for Environmental Health, Division of Laboratory Sciences. Atlanta, Georgia. NCEH. Pub. No. 05-0570.

Wixson, B.G., (1991). The Society of Environmental Geochemistry and Health (SEGH) Task Force Approach to the Assessment of Lead in Soil. Trace Substances in Environmental Health. 11-20.

Table G-1
Derivation of Site-Specific Soil Value
for Benzene¹
AOI 3 Site Characterization/Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Parameter	Abbreviation	Assumption	Units	Source
Transport Factor	TF	13100	mg/kg / mg/m ³	25 Pa. Code § 250, Appendix A Table 5
Absorption	Abs	1	unitless	25 Pa. Code § 250.307(d)
Exposure Time	ET	8	hr/day	25 Pa. Code § 250.307(d)
Exposure Frequency	EF	180	d/yr	25 Pa. Code § 250.307(d)
Target Risk ²	TR	0.0001	mg/kg	
Inhalation Cancer Slope Factor	CSF ₁	0.027	mg/kg-day ⁻¹	25 Pa. Code § 250, Appendix A Table 5
Averaging Time for Carcinogens	AT _C	70	yr	25 Pa. Code § 250.307(d)
Inhalation Factor	IF _{ADJ}	0.4	unitless	25 Pa. Code § 250.307(d)

Site-Specific, Non-Residential (Onsite Worker) Screening Value

2,160 mg/kg
2,160,000 ug/kg

Notes:

1. The site specific screening value was calculated for inhalation based on the calculation specified in 25 Pa. Code 250.307(b)(1)

$$\text{MSC (mg/kg)} = \frac{\text{TR} \times \text{AT}_C \times 365 \text{ days/year} \times \text{TF}}{\text{CSF}_1 \times \text{Abs} \times \text{ET} \times \text{EF} \times \text{IF}_{\text{ADJ}}}$$

2. The target risk level was modified from PADEP's default (1E-5) to 1E-4.

Table G-2
Derivation of Site-Specific Soil Value
for Lead¹
AOI 3 Site Characterization/Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Parameter	Abbreviation	Assumption	Units	Source
Blood lead target concentration	T	30	ug/dL	OSHA 29CFR1910.1025 App A
Geometric standard deviation of the blood lead distribution	G	1.4	unitless	25 Pa. Code § 250, Appendix A Table 7
Geometric mean background blood lead concentration from sources other than soil or dust (for ages > 20 years old)	B	1.56	ug/dL	NCEH Pub. No. 05-0570 (NCEH, 2005)
Number of standard deviations corresponding to the degree of protection required for the population at risk	n	1.645	unitless	25 Pa. Code § 250, Appendix A Table 7
Response of the blood lead versus soil lead relationship	δ	5	ug/dL blood / ug/g soil	DEFRA, 2002

Site-Specific, Non-Residential (Onsite Worker) Screening Value

3,140 ug/g (mg/kg)
3,140,000 ug/kg

Notes:

1. The site specific screening value for Lead was calculated for ingestion based on the SEGH model as specified by 25 Pa. Code 250.306(e)

$$MSC \text{ (mg/kg)} = \frac{[(T/G^n) - B] \times 1000}{\delta}$$

DEFRA. (2002). Soil Guideline values for Lead Contamination. Bristol, UK: R&D Publication SGV 10 Environment Agency.

NCEH. (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, National Center for Environmental Health, Division of Laboratory Sciences. Atlanta, Georgia. NCEH. Pub. No. 05-0570.

**Table G-3
Summary of Site Specific Cumulative Risk Evaluation
AOI 3 Site Characterization Report**

Location ID	Sample ID*	Sample Interval	Sample Date	Benzene (71-43-2)		Lead (7439-92-1)	
				Reported Result (ug/kg)	Calculated Risk	Reported Result (mg/kg)	Calculated Blood Lead Concentration ⁴ (ug/dL)
Region III RBC⁵				5,400		800	
AOI-3	BH-10-01_1-2	1-2	4/26/2010	750	3.48E-08	130	3
AOI-3	BH-10-02_1-2	1-2	4/26/2010	300	1.39E-08	5,540	3
AOI-3	BH-10-03_1-2	1-2	4/27/2010	ND	--	73.9	3
AOI-3	BH-10-04_1-2	1-2	5/13/2010	ND	--	32.2	3
AOI-3	S-280_1-2	1-2	4/28/2010	ND	--	266	3
AOI-3	S-282_1-2	1-2	4/27/2010	ND	--	87.3	3
AOI-3	S-284_1-2	1-2	5/13/2010	ND	--	14.3	3
AOI-3	S-285_1-2	1-2	4/27/2010	17	7.90E-10	536	3
AOI-3	S-286_1-2	1-2	4/27/2010	31	1.44E-09	151	3
AOI-3	S-288_1-2	1-2	6/17/2010	8	3.72E-10	223	3
AOI-3	S-290_1-2	1-2	4/27/2010	34	1.58E-09	320	3
AOI-3	S-291_1-2	1-2	4/26/2010	ND	--	254	3
Cumulative Total¹ :					5.30E-08		

Total Cumulative Risk for Carcinogens²: 5.30E-08 < 1 in 10,000

Notes:

ND - Not Detected

BOLD - Indicates locations with concentrations exceeding PADEP's Non-Residential Soil MSC.

¹ Cumulative total of detected concentrations greater than the PADEP Non-Residential Soil MSC.

² Total cumulative risk of detected concentrations of carcinogenic compounds (benzene) greater than the PADEP Non-Residential Soil MSC

³ Total Hazard Index of detected concentrations of non-carcinogenic compounds greater than the PADEP Non-Residential Soil MSC.

⁴ Calculated based on site specific parameters provided in Table F-6. OSHA, 29CFR1910.1025, Appendix A, recommends that blood lead levels be maintained below 30 ug/dL.

⁵ http://www.epa.gov/reg3hscd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_MAY2010.pdf

*All soil samples collected and analyzed were unsaturated.

APPENDIX H

LNAPL Characterization Data

Appendix H
Table 1
AOI 3 LNAPL Characterization Summary Table
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Interpretation of Product Types, Proportions, and Weathering						Similarities to Other Samples in Study		
<i>Characterization Results Compiled for CCR (TGI Job No. 04046 - Analyzed in March 2004)</i>								
Well ID	Density g/cc (60°F)	LNAPL Type(s)	Torkelson LNAPL Type(s)	Proportion (%)	Weathering	Quite Similar To	Fairly Similar To	Somewhat Similar To
S-21	0.9281	Residual Oil	Residual Oil	100	Extreme	S-92 & S-158	N-78 & S-142	All other residual oils in the study except A-133
S-59	0.8039	Gasoline	?Gasoline	60	Severe		B-39, B-129, S-78, S-117, & S-138	All other gasolines in study
			Middle Distillate	40	Extreme			
S-60	0.7898	Aviation Gasoline	Aviation Gasoline	80	Extreme	S-103	WP-9-2	All other aviation gasolines in study
			Middle Distillate	20				All other middle distillates in the study
S-68/S-29	0.855	Middle Distillate	Middle Distillate	100	Highly		S-29	All other middle distillates in the study
BF-106	0.8199	Condensate	Condensate	100	Highly			S-130
BF-107	0.8671	Middle Distillate	Middle Distillate	100	Severe	S-32, S-53, S-56, & S-97		All other middle distillates in the study
<i>Characterization Results Compiled for AOI 3 Site Characterization Activities (TGI Job No. 10099 - Analyzed in July 2010)</i>								
S-282	0.8104	Middle Distillate	Middle Distillate	70	Extreme			S-315
			Aviation Gasoline	20	Severe		S-297	
			Heavier Material	10	Extreme			All other heavier materials in the study
S-285	0.8921	Middle Distillate	Middle Distillate	80	Extreme	Unique		All other heavier materials in the study
			Heavier Material	20				
			Unknown Lt. Material	<1		Unique		

Notes:

Heavier material could either be crude oil or residual oil.
g/cc - Grams per cubic centimeter
TGI - Torkelson Geochemistry, Inc.
NA - Not Applicable
? - Tentative identification
CCR - 2004 Sunoco Current Conditions Report
LNAPL - Light Non Aqueous Phase Liquid
All LNAPL results reported were analyzed by TGI.
Product interpretations were provided by TGI.



Torkelson Geochemistry, Inc.

2528 S. Columbia Place
Tulsa, OK 74114-3233

Phone: 918-749-8441
Fax: 918-749-6005

e-mail: BTorkelson@torkelsongeochemistry.com

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project: Sunoco, Inc. Philadelphia Refinery
Location: 3144 Passyunk Avenue, Philadelphia, PA 19146
P.O.:
Proj. No.: A012, 3, & 7 SCRs/RIRs
P.O.:
Sampled By: Tim Dalk

Report/Bill To: Langan Engineering & Envtl Services
Address: P.O. Box 1569
Doylesstown, PA 18901-0219
Phone: 215.491.6500
Fax: 215.491.6501
e-mail: dvaldes@langan.com

Additional Instructions

Samples to be analyzed for Fingerprint (GC Characterization) and Density. Include a "Brief Description/Interpretation" of LNAPL, to be consistent with existing LNAPL types for Sunoco Philadelphia. Must have data results no later than July 30, 2010.

Requested Turn-Around Time: Data needed by July 30th

ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Title # OF Vials	Notes	PRESERVATIVES		ANALYSES REQUESTED							REMARKS				
							Fingerprint-GC Characterization	Density	Viscosity	Water Surface Tension	NAPL Surface Tension	NAPL/Water Interfac. Tens.	Lead	Sulfur						
1	S-282	7/5/10	Prod		1	XX	XX	XX												
2	S-285				1															
3	S-297				1															
4	S-313				1															
5	S-315				1															
6	C-143	7/5/10	Prod		1	XX	XX	XX												
7																				
8																				
9																				
10																				

A01-3
A01-3
A01-2
A01-2
A01-2
A01-7

RELINQUISHED BY	ACCEPTED BY	DATE	TIME
<i>[Signature]</i>	T-S DRAKE	08-16	
RELEASED TO FED EX EXP.	SAME DATE		
	<i>[Signature]</i>	7-19-10	0845

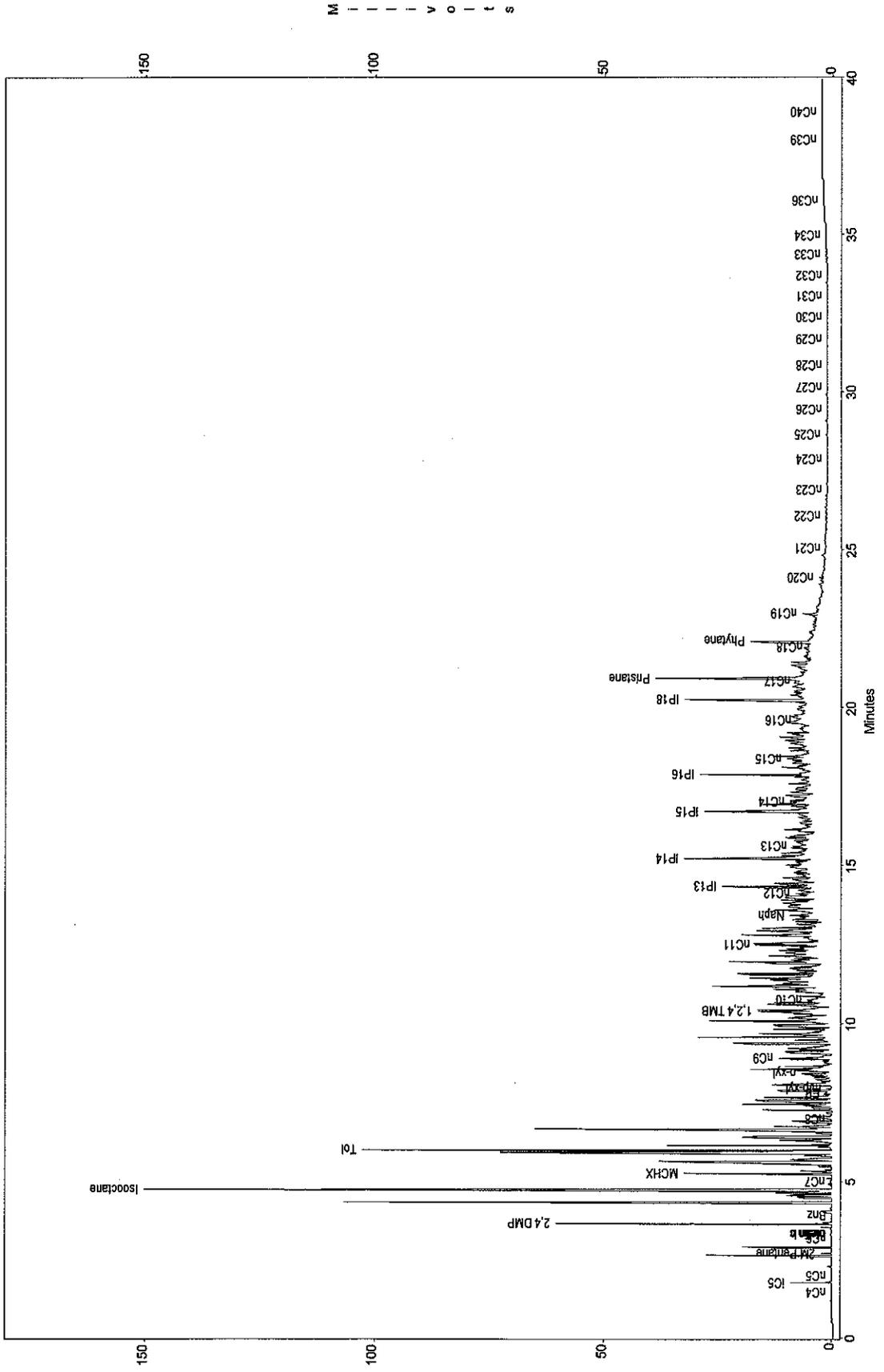
Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery

Sample ID : S-297

Acquired : Jul 20, 2010 10:38:19

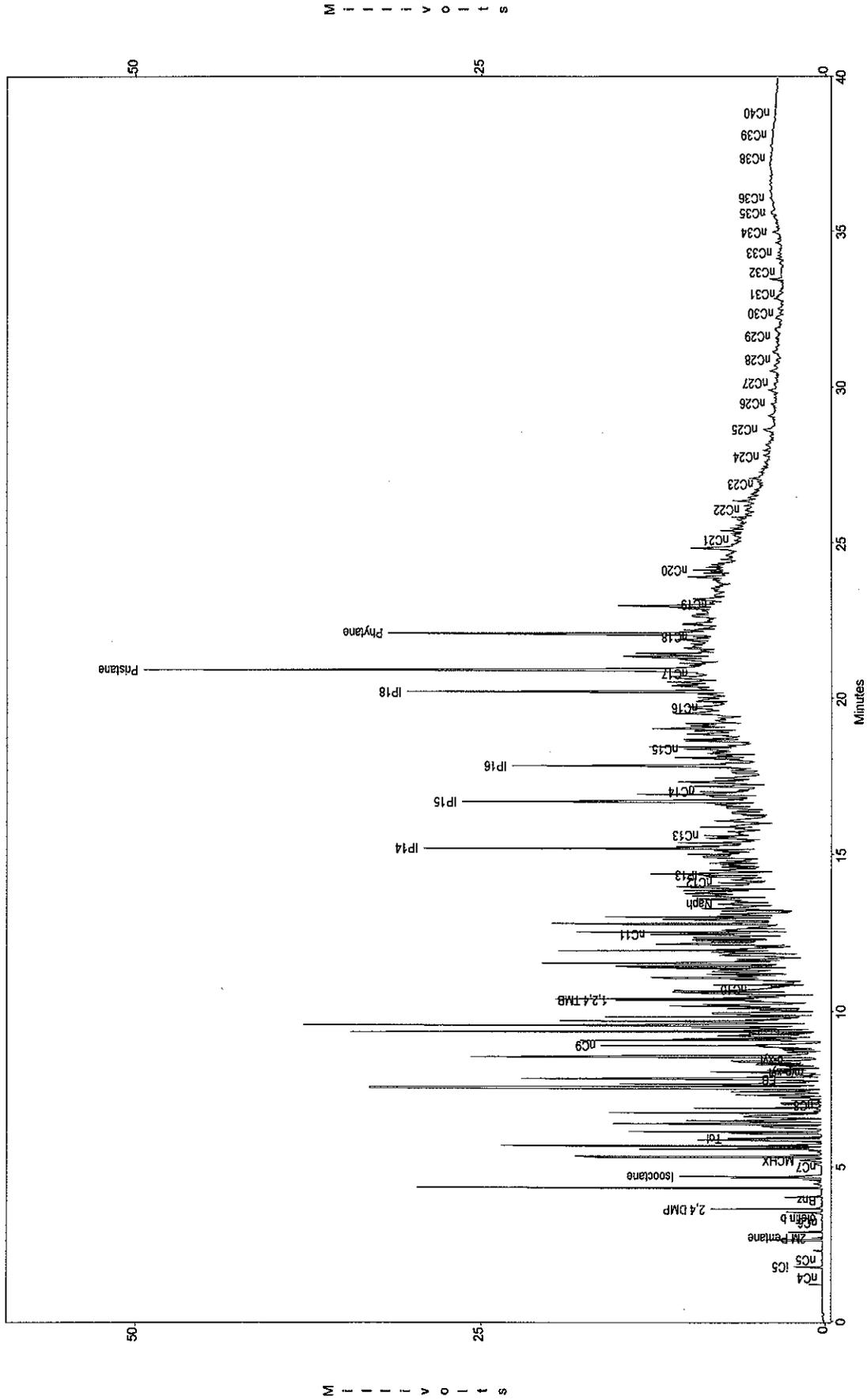
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Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : S-313
Acquired : Jul 20, 2010 14:02:27

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M i i i i v o i t s

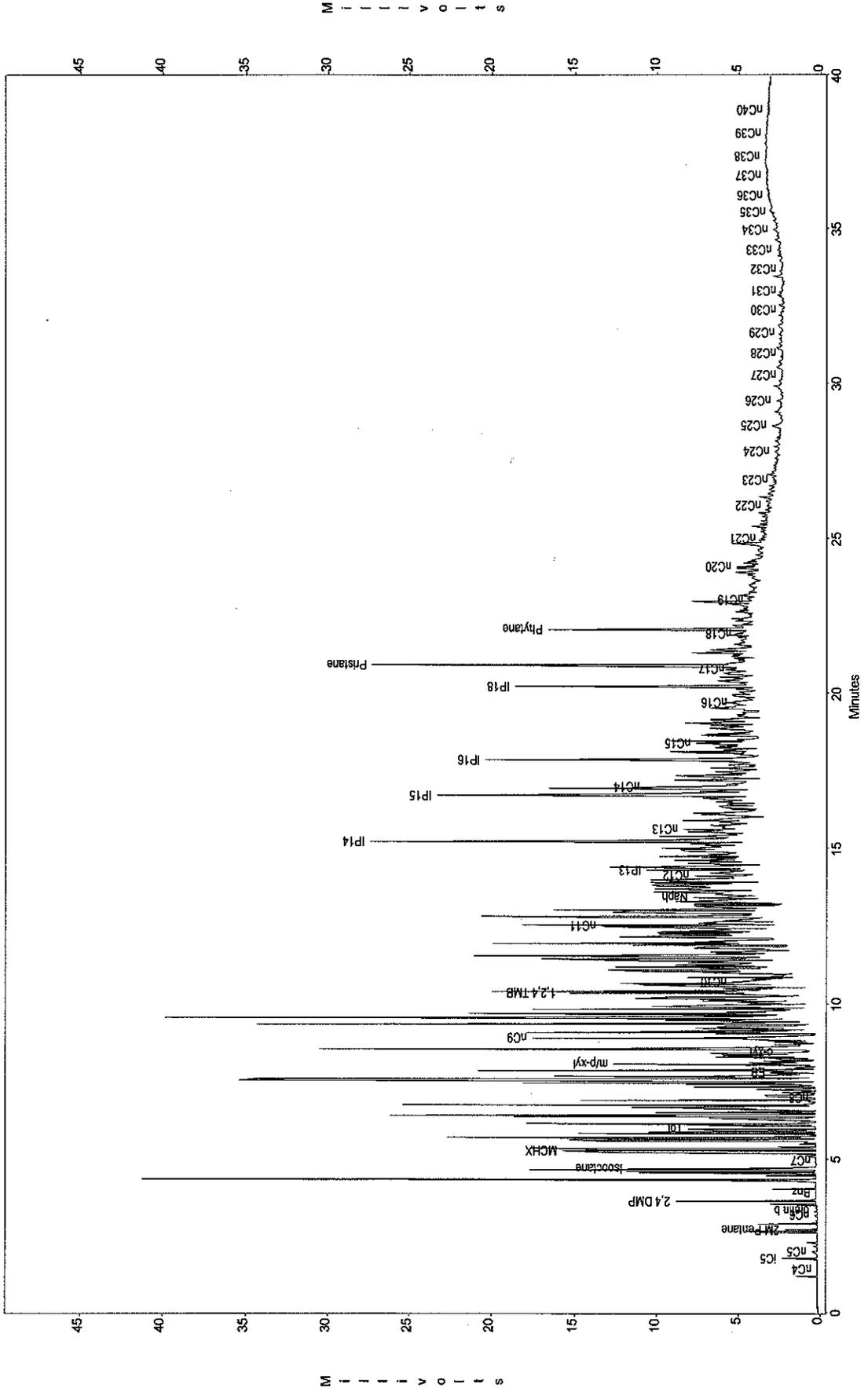
Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery

Sample ID : S-315

Acquired : Jul 20, 2010 13:11:48

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M i i i i v o l t s

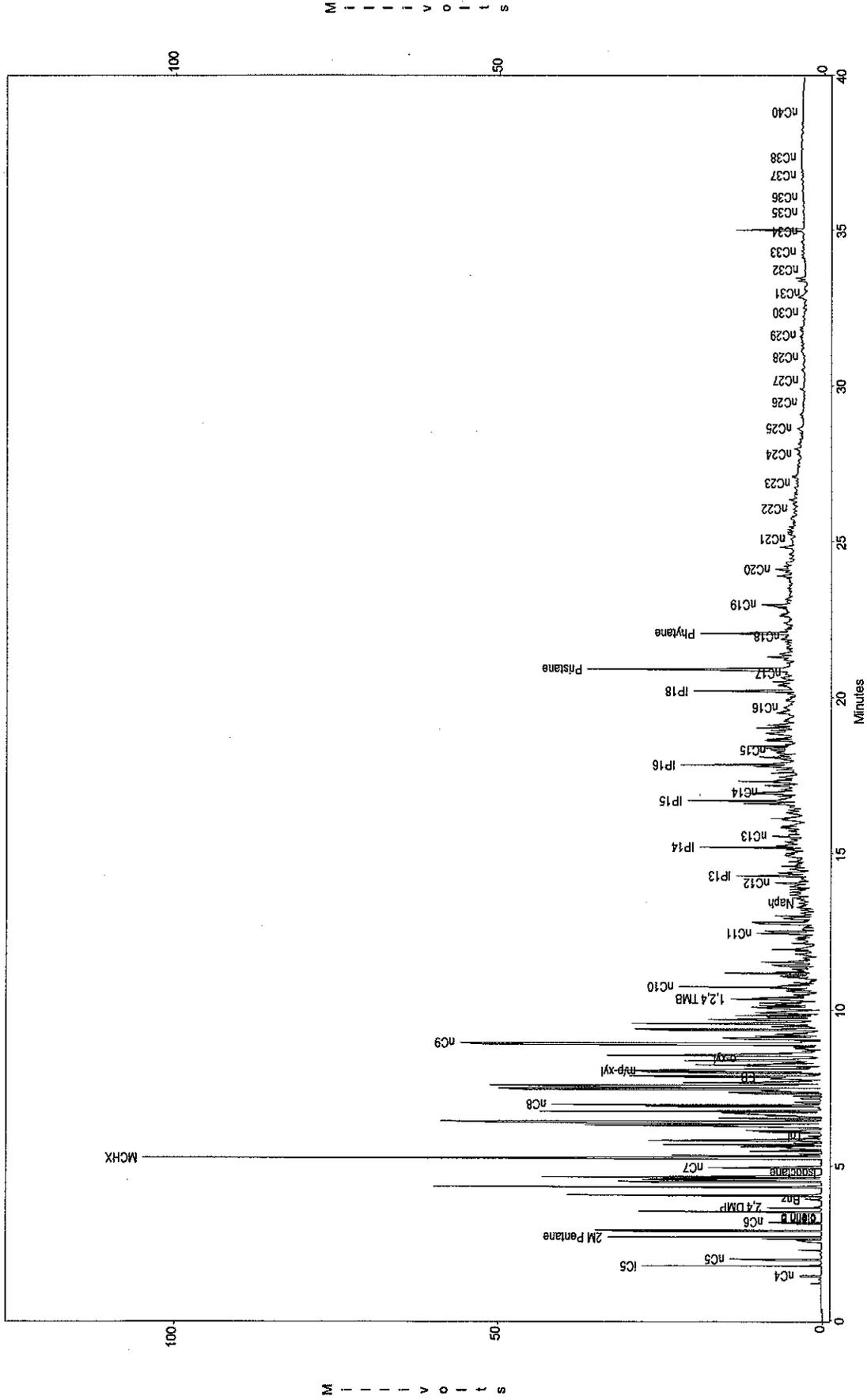
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Sunoco, Inc., Philadelphia Refinery

Sample ID : C-143

Acquired : Jul 20, 2010 11:28:51

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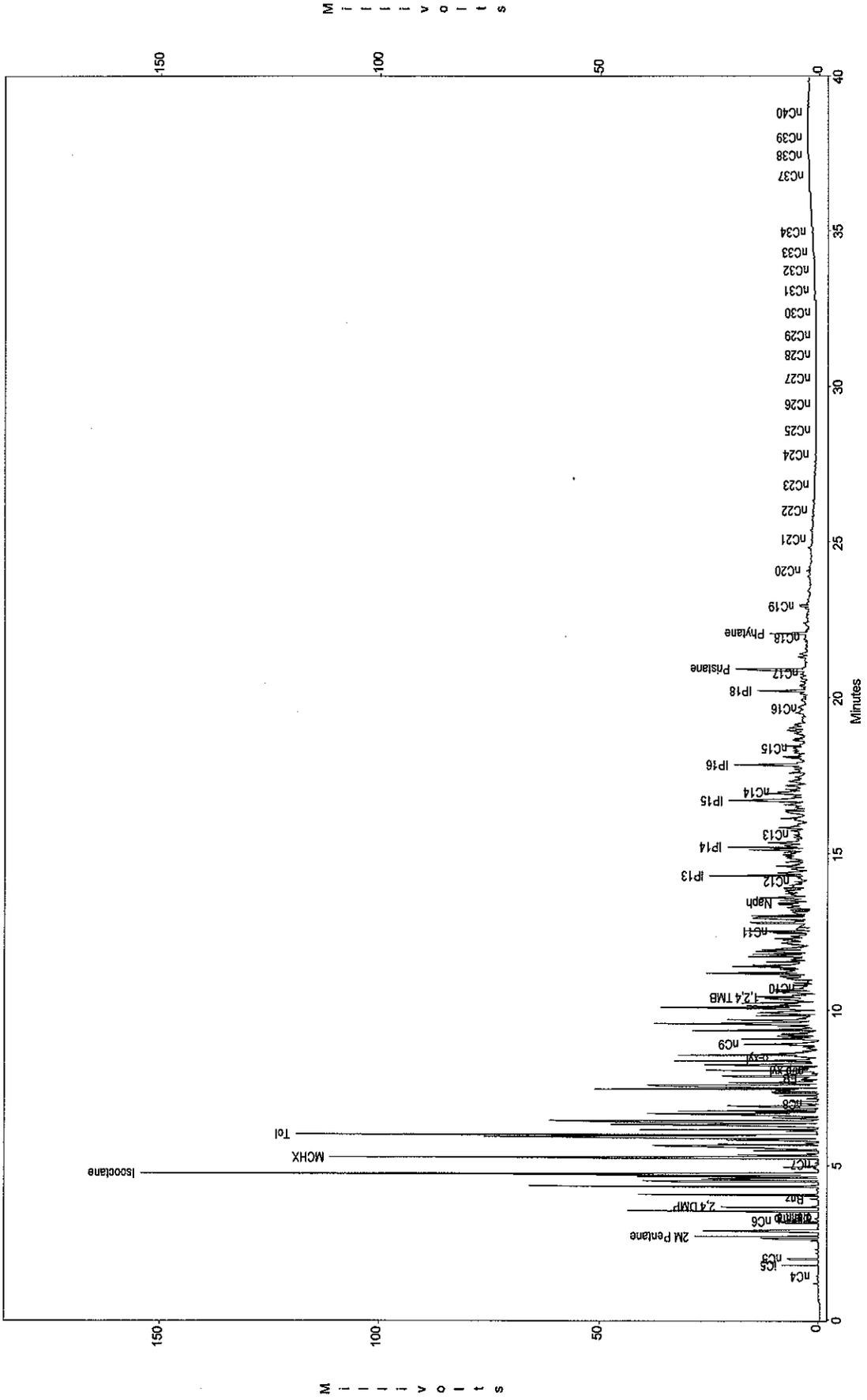
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Sunoco, Inc., Philadelphia Refinery

Sample ID : S-282

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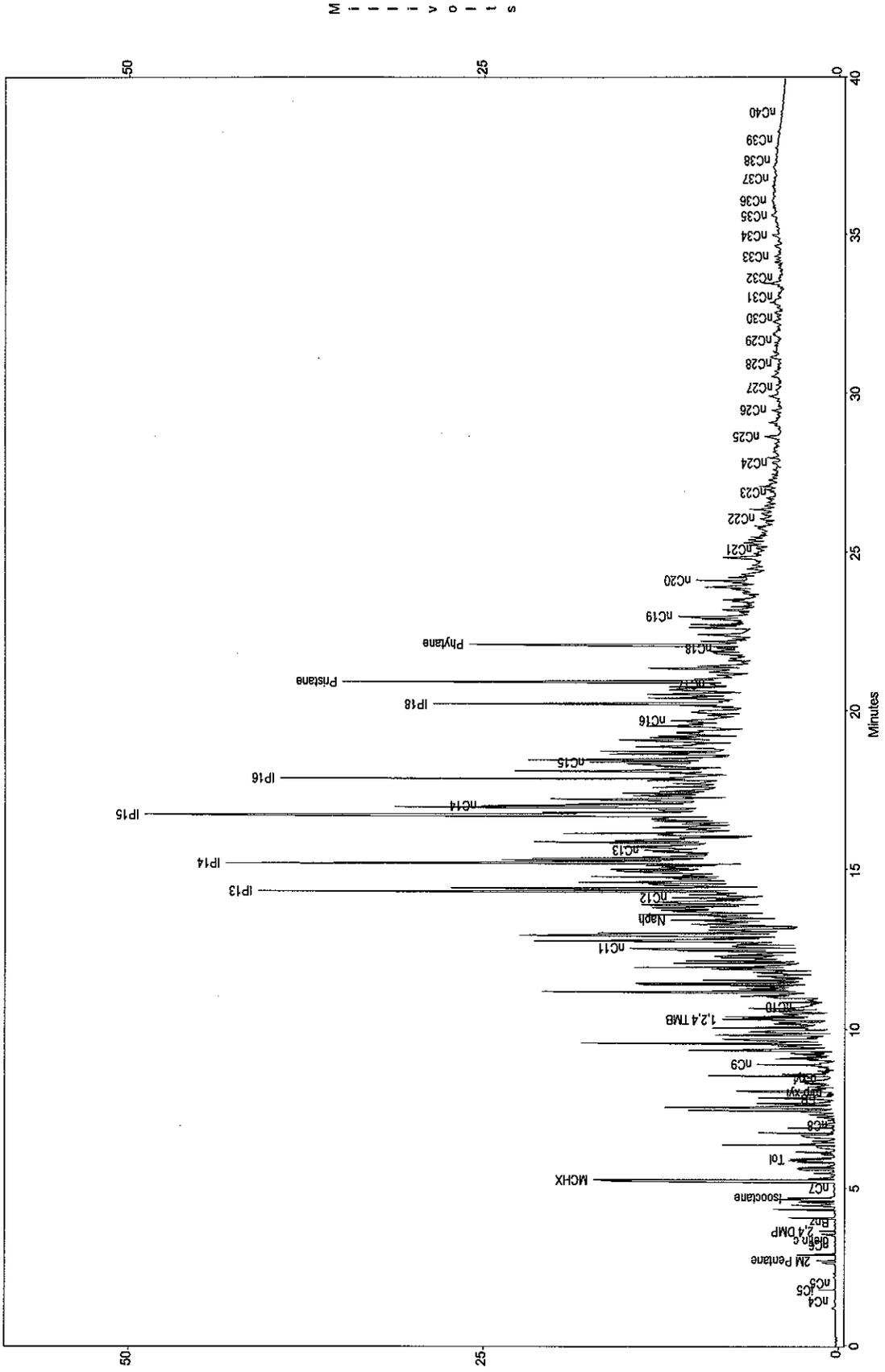
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Sunoco, Inc., Philadelphia Refinery

Sample ID : S-285

Acquired : Jul 20, 2010 15:01:23

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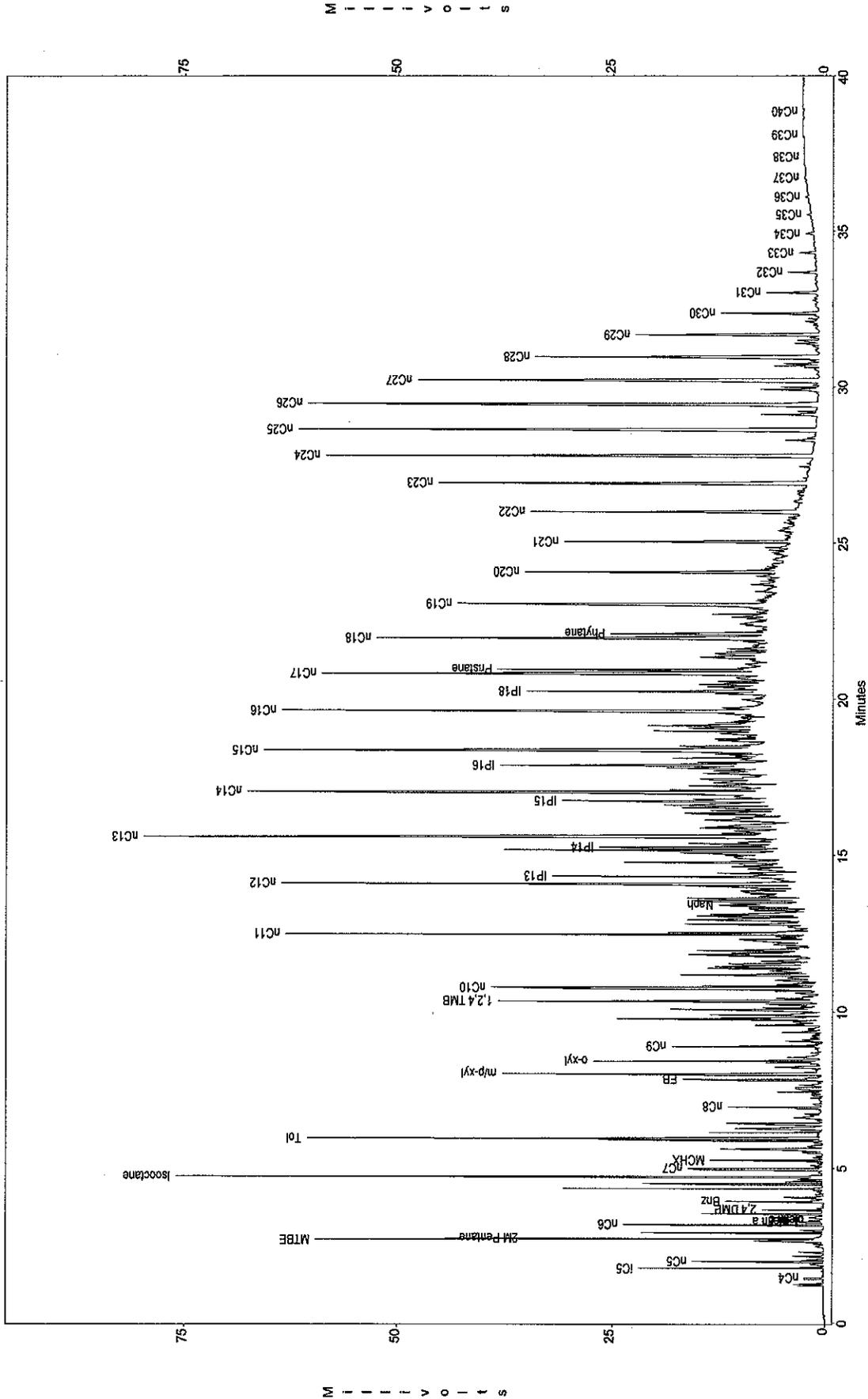
M I I I I V O I I I S

M I I I I V O I I I S

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : Gas/Dies/Wax std
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Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery

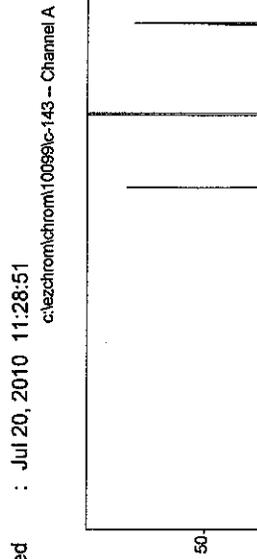
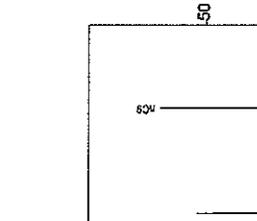
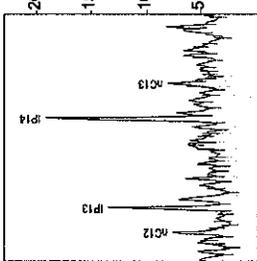
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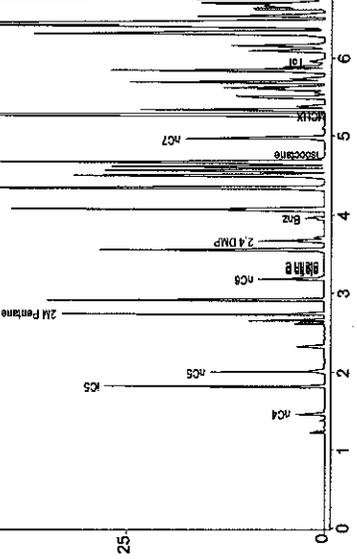
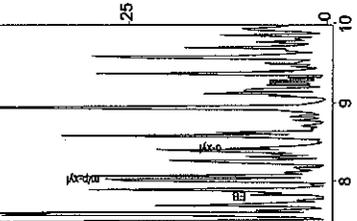
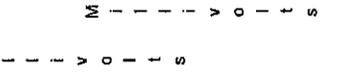
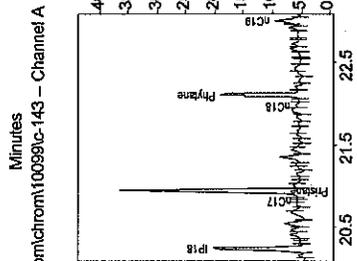
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c:\ezchrom\chrom1\0099c-143 - Channel A

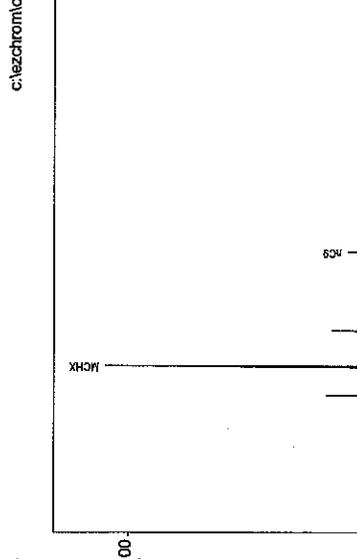
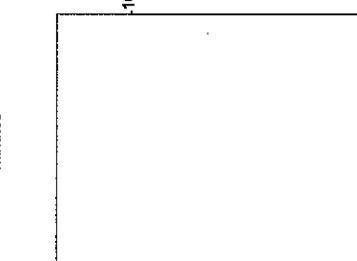
c:\ezchrom\chrom1\0099c-143 - Channel A



M i i i i i V o i i i t t s

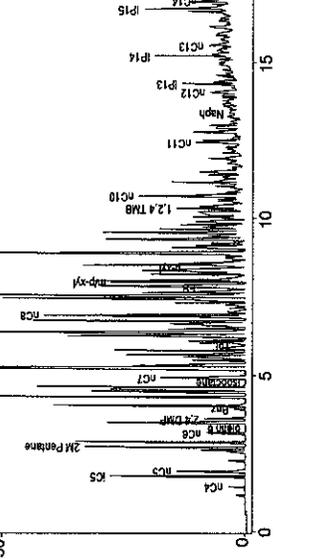
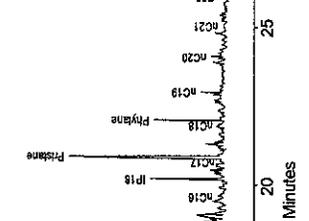
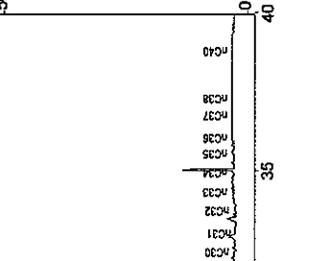


M i i i i i V o i i i t t s



M i i i i i V o i i i t t s

Peak	Area	Height
nC4	2686	3538
nC5	20859	2746
nC6	11629	14306
nC7	30350	33150
nC8	8194	8347
nC9	31	22
nC10	87	79
nC11	170	131
nC12	8824	8480
nC13	3262	2470
nC14	66	28
nC15	20852	17512
nC16	17672	10422
nC17	3534	2465
nC18	52265	41536
nC19	19984	9580
nC20	49764	27779
nC21	27084	12423
nC22	103249	55760
nC23	21432	13804
nC24	36596	21414
nC25	18458	9121
nC26	5146	2309
nC27	13846	5931
nC28	23181	11725
nC29	30550	17182
nC30	12747	6818
nC31	37102	18746
nC32	28555	7689
nC33	37790	19441
nC34	19382	5566
nC35	7722	3124
nC36	42487	17021
nC37	5390	2584
nC38	81885	33254
nC39	6851	2466
nC40	41071	15365
nC41	18528	5838
nC42	8963	3423
nC43	2753	766
nC44	2350	782
nC45	1492	493
nC46	1618	483
nC47	2799	700
nC48	1023	328
nC49	280	104
nC50	304	155
nC51	741	432
nC52	386	214
nC53	59	36
nC54	333	172
nC55	1103	385
nC56	46	61
nC57	190	102
nC58	147	91
nC59	30	46
nC60	39	44
nC61	0	0
nC62	108	108



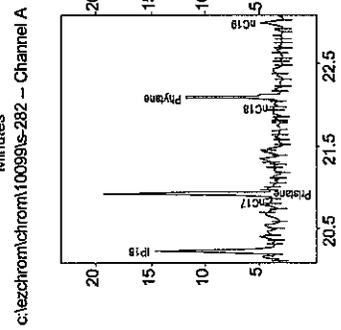
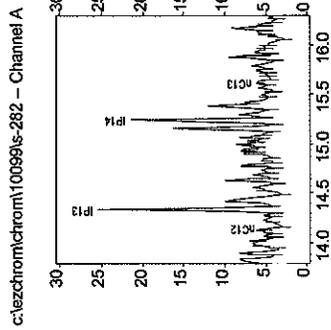
M i i i i i V o i i i t t s

Torkelson Geochemistry, Inc.

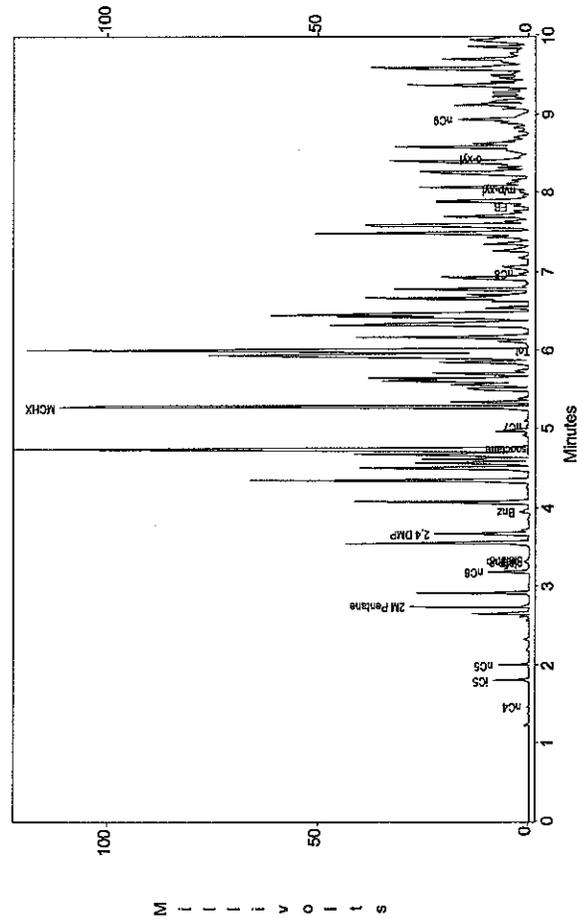
Sunoco, Inc., Philadelphia Refinery
 Sample ID : S-282
 Acquired : Jul 20, 2010 12:19:51

Channel A Results

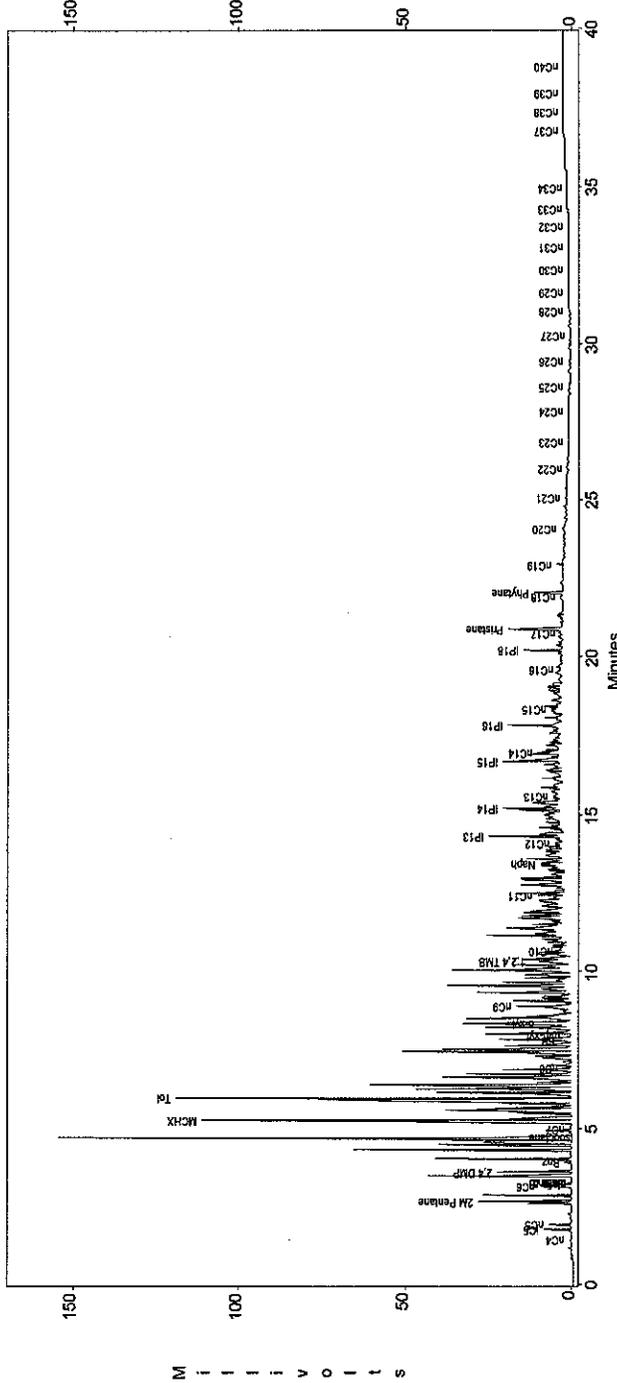
Peak	Area	Height
nC4	613	413
iC5	6385	8603
nC5	5842	7271
nC6	0	0
2M Pentane	25979	28465
nC6	9651	9698
olefin a	267	250
olefin b	1116	1001
olefin c	589	446
2,4 DMP	23606	22556
Bnz	3163	2349
Isocane	299102	154391
nC7	888	627
MCHX	192023	111391
Tol	214424	118561
nC8	3212	2532
EB	5400	3765
m/p-xy	3713	2192
o-xy	11140	10112
nC9	31252	16912
1,2,4 TH6	16970	11670
nC10	7402	3235
nC11	16239	8213
Meph	17069	7443
nC12	5874	3289
IP13	40678	22509
IP14	31468	16695
nC13	9703	3413
IP15	34942	19125
nC14	19906	7423
IP16	32439	16402
nC15	4793	2130
nC16	1643	1646
IP18	27814	11563
nC17	3011	1060
Pristane	35702	16445
nC18	1769	888
Phyrene	19665	9901
nC19	5124	2134
nC20	2822	1087
nC21	1171	384
nC22	295	180
nC23	76	43
nC24	487	191
nC25	1207	251
nC26	563	163
nC27	247	58
nC28	72	37
nC29	194	99
nC30	198	90
nC31	83	34
nC32	67	37
nC33	53	34
nC34	90	43
nC35	0	0
nC36	0	0
nC37	78	40
nC38	58	27
nC39	126	26
nC40	45	17



c:\ezchrom\chrom\10099s-282 - Channel A



c:\ezchrom\chrom\10099s-282 - Channel A



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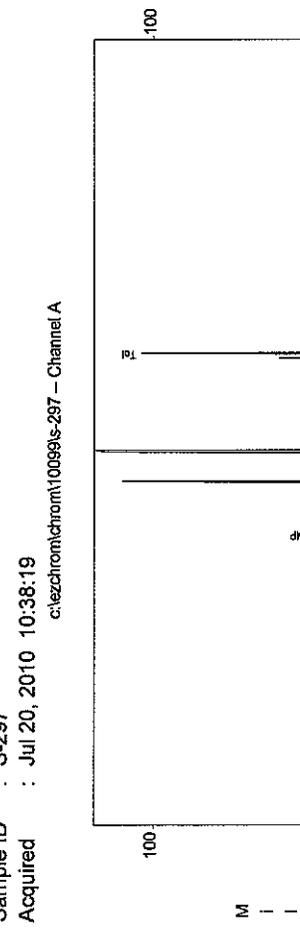
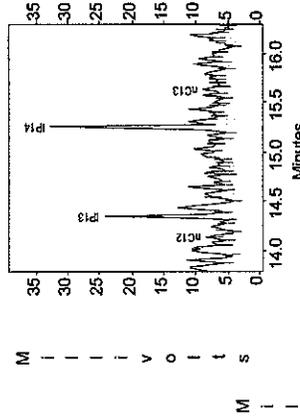
Channel A Results

Peak	Area	Height
nC4	63	70
iC5	6008	9247
nC5	38	29
nB6	0	0
2M Pentane	2602	2620
nC6	33	27
olefin a	0	0
olefin b	204	205
olefin c	519	439
2,4 DMP	66668	60475
Bnz	255	199
Isooctane	292515	150440
nC7	564	490
nC8	39219	32508
Tol	115937	102754
nC9	494	408
EB	2426	1514
m/p-xy	2055	1194
o-xy	9020	6516
nC9	21246	11819
1,2,4 THB	24577	15782
nC10	7811	4107
nC11	28557	14648
Naph	11765	6652
nC12	5991	3837
IP13	37220	20236
IP14	51503	28733
nC13	14185	4971
IP15	43217	24955
nC14	9199	5114
IP16	46807	24547
nC15	9104	3937
nC16	6142	3334
IP18	70459	20211
nC17	9949	4347
Pristane	97158	35244
nC18	5382	2411
Pyrene	36733	15011
nC19	12604	4082
nC20	2542	998
nC21	134	132
nC22	659	210
nC23	166	124
nC24	671	199
nC25	1842	348
nC26	626	208
nC27	305	113
nC28	282	79
nC29	212	80
nC30	159	42
nC31	46	25
nC32	92	39
nC33	40	25
nC34	393	78
nC35	0	0
nC36	706	50
nC37	0	0
nC38	0	0
nC39	184	31
nC40	72	26

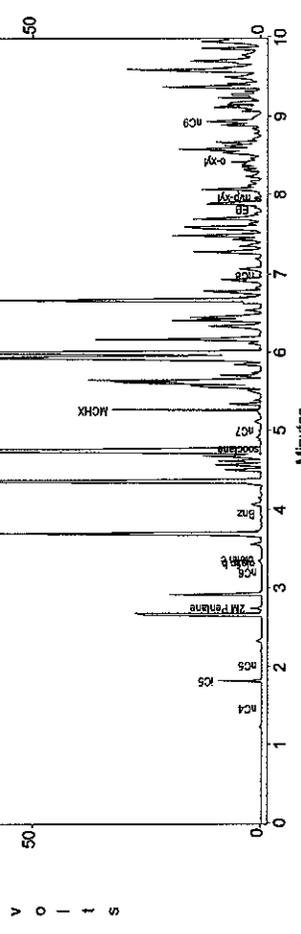
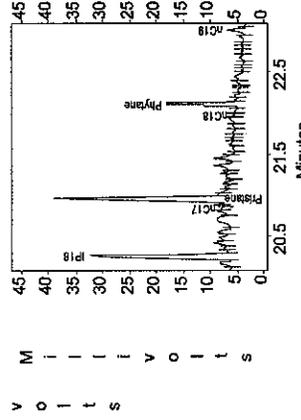
Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
 Sample ID : S-297
 Acquired : Jul 20, 2010 10:38:19

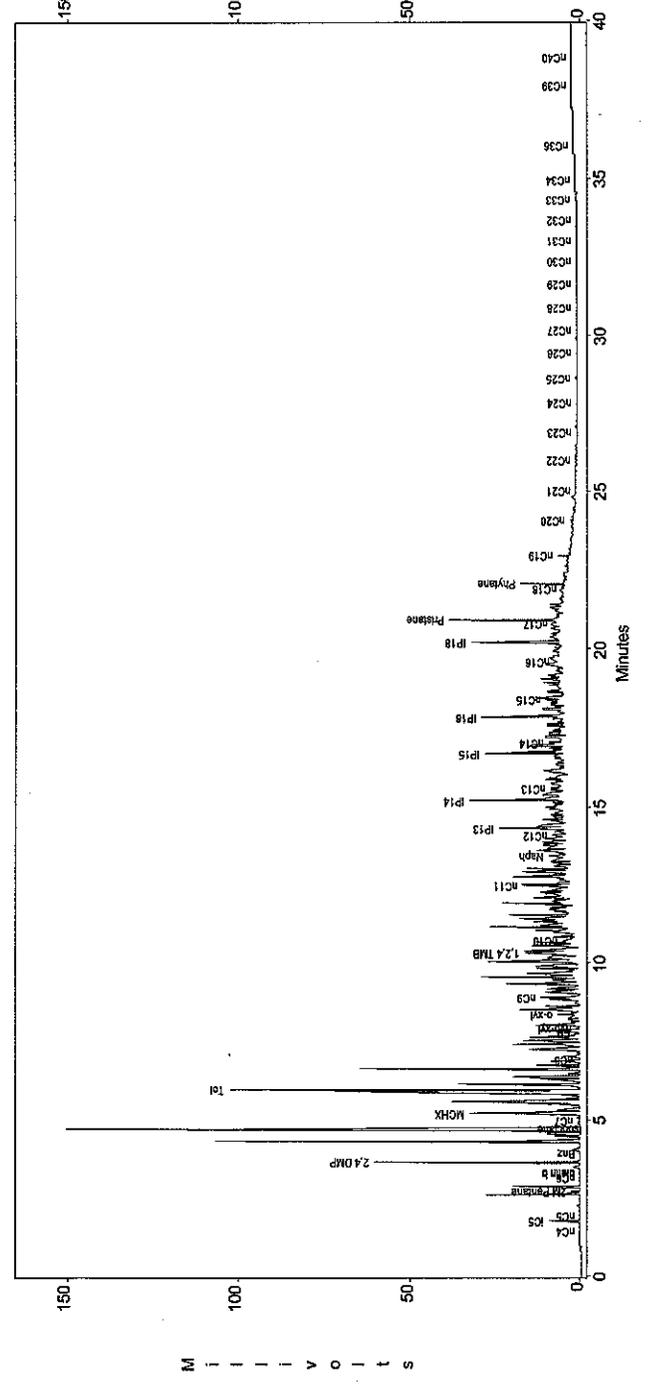
c:\ezchrom\chrom\10099s-297 - Channel A



c:\ezchrom\chrom\10099s-297 - Channel A



c:\ezchrom\chrom\10099s-297 - Channel A



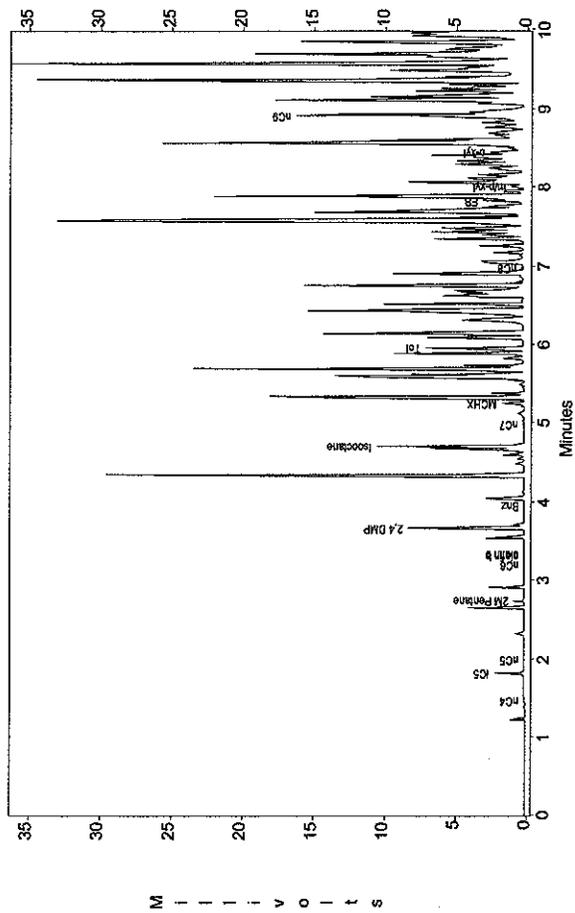
Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery

Sample ID : S-313

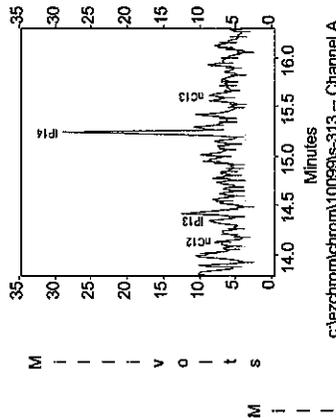
Acquired : Jul 20, 2010 14:02:27

c:\ezchrom\chrom1\10099s-313 - Channel A



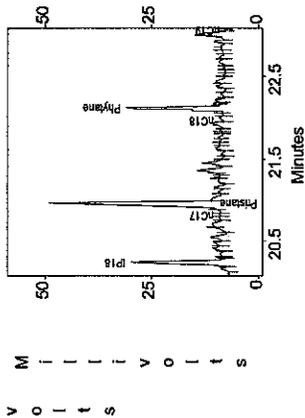
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c:\ezchrom\chrom1\10099s-313 - Channel A



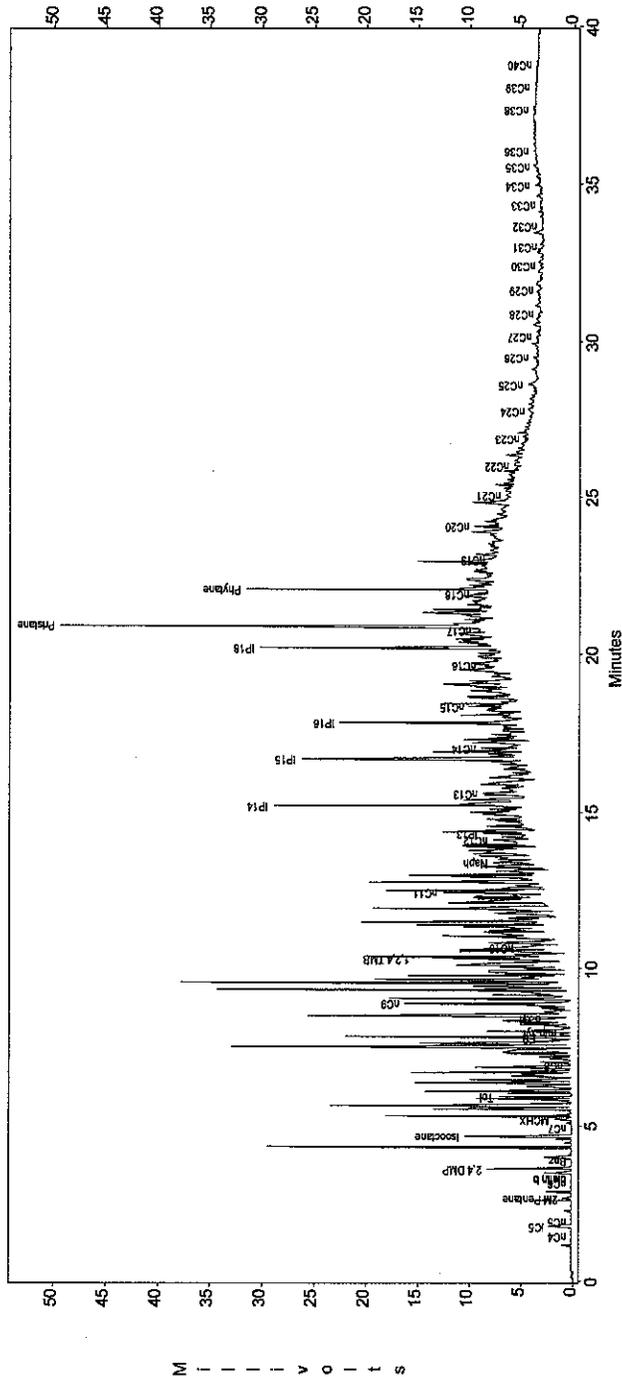
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c:\ezchrom\chrom1\10099s-313 - Channel A



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c:\ezchrom\chrom1\10099s-313 - Channel A



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Channel A Results

Peak	Area	Height
nC4	16	22
nC5	1590	2144
nC6	95	103
nC7	0	0
2M Pentane	760	789
nC8	16	13
olefin a	0	0
olefin b	61	61
olefin c	78	58
2,4 DMP	8270	8163
nC9	37	30
Isooctane	11514	10348
nC10	100	42
MCHX	1089	1536
nC11	8229	6883
nC12	257	195
nC13	4111	2895
nC14	1287	849
nC15	4638	2332
nC16	29478	15564
nC17	23119	14885
nC18	9201	4673
nC19	19588	9934
nC20	8387	4416
nC21	7127	4106
nC22	19074	5165
nC23	45587	25286
nC24	14478	5033
nC25	31594	21987
nC26	11210	4286
nC27	34225	17843
nC28	8342	3882
nC29	3575	2279
nC30	5874	23036
nC31	4206	2132
nC32	11281	41851
nC33	4111	1874
nC34	58225	23553
nC35	292	373
nC36	7346	3081
nC37	2093	802
nC38	1841	688
nC39	751	290
nC40	685	361
nC41	4194	898
nC42	1443	448
nC43	774	282
nC44	74	107
nC45	664	278
nC46	483	201
nC47	259	141
nC48	249	151
nC49	875	233
nC50	2082	486
nC51	302	139
nC52	159	136
nC53	0	0
nC54	77	69
nC55	65	46
nC56	45	45

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery

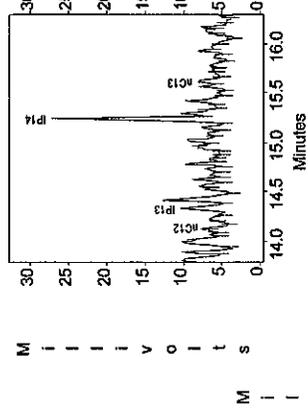
Sample ID : S-315

Acquired : Jul 20, 2010 13:11:48

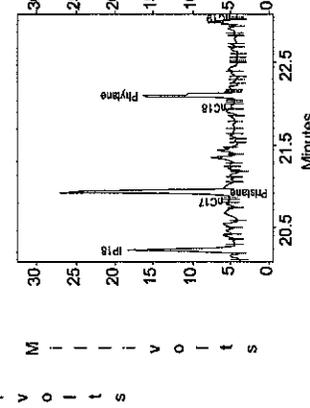
Channel A Results

Peak	Area	Height
nC4	39	35
iC5	1591	2136
nC5	274	308
nBz	0	0
2M Pentane	1840	1931
nC6	151	137
olefin a	0	0
olefin b	155	146
olefin c	161	128
2,4 DMP	8780	8580
Bnz	62	36
Isocotane	12393	11584
nC7	62	58
MCHX	18767	15448
Tol	9212	7764
nC8	223	165
EB	3937	2792
m/p-xy1	18376	12334
o-xy1	4392	2842
nC9	31438	17237
1,2,4 THB	28978	14899
nC10	9224	4129
nC11	21185	10648
Naph	10213	4660
nC12	5306	3225
IP13	29513	6660
IP14	42657	23771
nC13	13743	4899
IP15	37552	19705
nC14	19613	7449
IP16	29613	16621
nC15	6110	3008
nC16	2286	1629
IP18	34525	14832
nC17	3622	1831
Prisotane	54083	23565
nC18	3686	1441
Phytane	30393	12911
nC19	1055	712
nC20	3019	1458
nC21	563	382
nC22	835	349
nC23	396	289
nC24	1606	306
nC25	3112	629
nC26	1065	359
nC27	70	63
nC28	225	81
nC29	263	180
nC30	367	134
nC31	176	183
nC32	179	79
nC33	224	100
nC34	1290	285
nC35	50	34
nC36	402	100
nC37	76	40
nC38	110	54
nC39	42	22
nC40	97	50

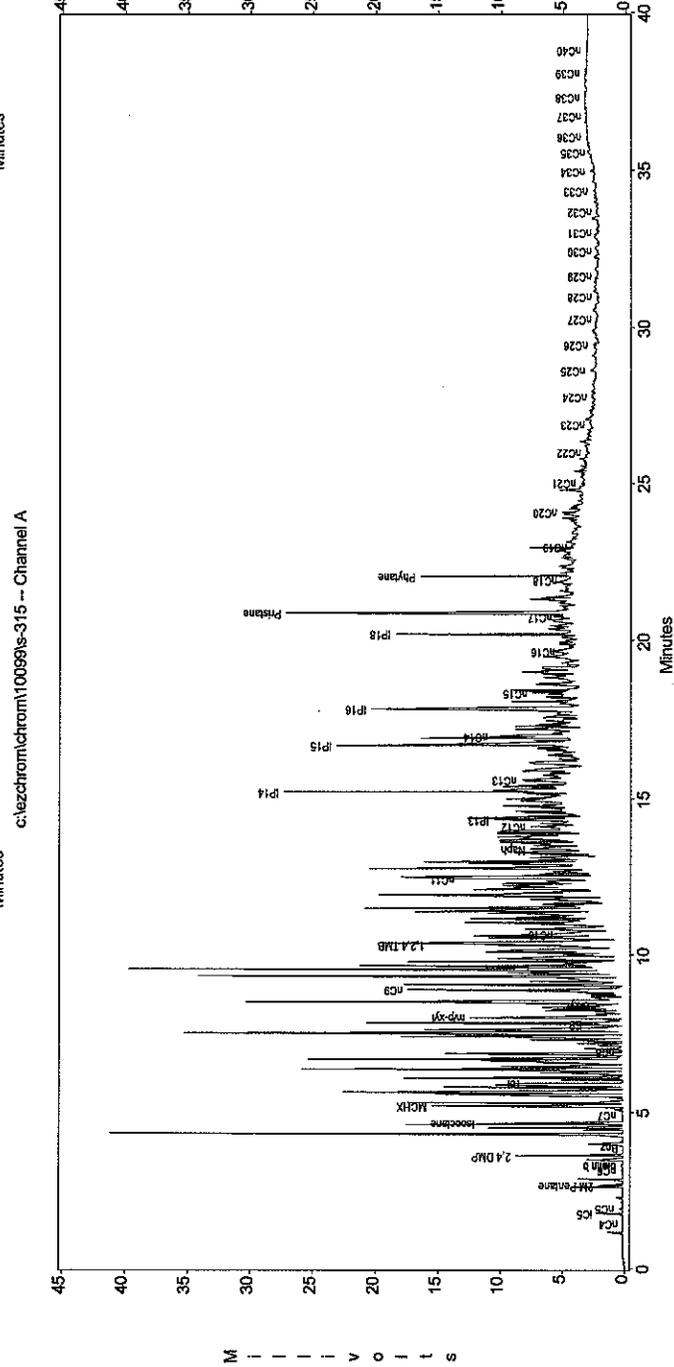
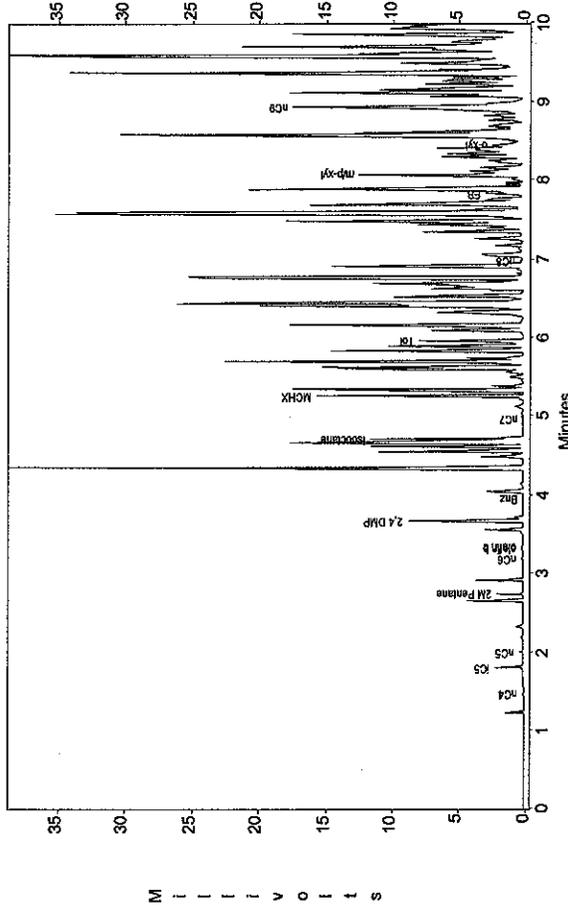
c:\ezchrom\chrom1\10099s-315 -- Channel A



c:\ezchrom\chrom1\10099s-315 -- Channel A



c:\ezchrom\chrom1\10099s-315 -- Channel A



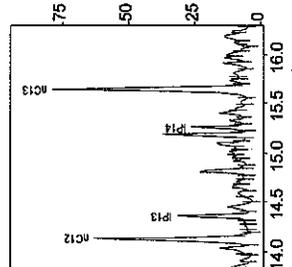
Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
 Sample ID : Gas/Dies/Wax std
 Acquired : Jul 20, 2010 09:47:53

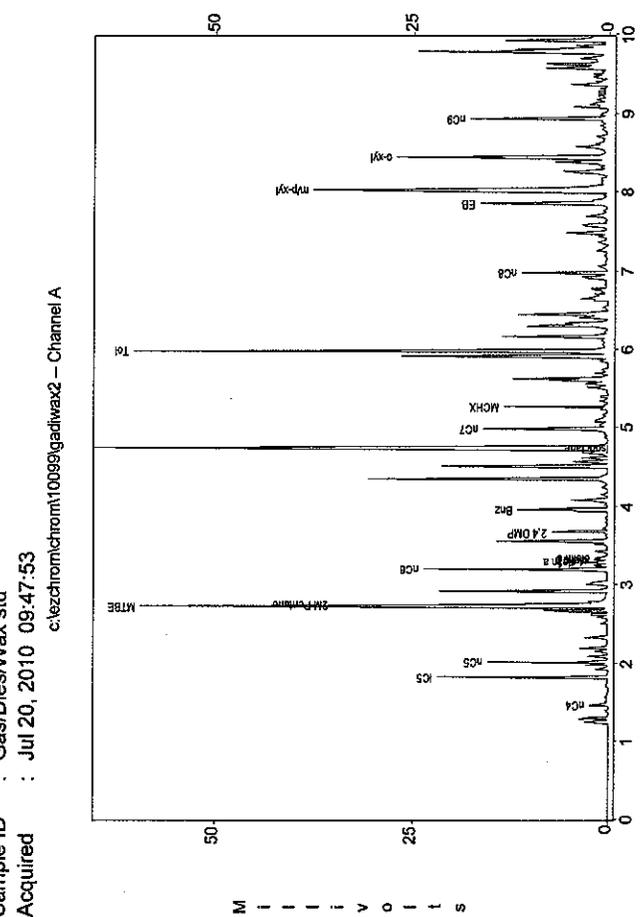
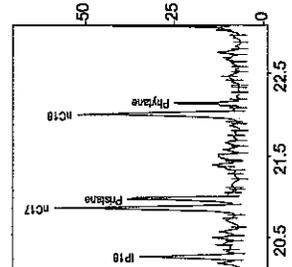
Channel A Results

Peak	Area	Height
nC4	1984	2368
iC5	15414	21915
nC5	11667	15453
nBz	49307	59479
Zn Pentane	35056	34918
nC6	22200	23339
olefin a	3612	3418
olefin b	1724	1722
olefin c	1971	1548
2,4 DMF	7274	7143
Bnz	14167	11489
Isocetane	105230	75535
nC7	19179	15920
MCHX	15682	13181
Tol	8518	66313
nC8	13430	11022
EB	23107	16349
m/p-xyl	81108	37519
o-xyl	39737	26870
nC9	24717	17590
1,2,4 THB	68131	37505
nC10	61257	38172
nC11	124394	61224
Naph	19825	9956
nC12	132822	66646
IP13	35562	28390
IP14	40706	22703
nC13	176610	75744
IP15	39477	24563
nC14	151755	60419
IP16	75900	32151
nC15	156310	59696
nC16	142887	57795
IP18	65882	28620
nC17	129725	52397
Prisane	74492	31931
nC18	97220	45871
Phytane	40775	18464
nC19	83344	36711
nC20	61701	30048
nC21	54890	26638
nC22	68336	31525
nC23	106107	43174
nC24	160461	57025
nC25	166168	60645
nC26	183641	59685
nC27	134561	46943
nC28	82385	33357
nC29	48276	21855
nC30	21960	11336
nC31	11214	6091
nC32	6031	3388
nC33	3267	1886
nC34	1852	992
nC35	1084	567
nC36	546	285
nC37	326	167
nC38	241	92
nC39	236	68
nC40	153	45

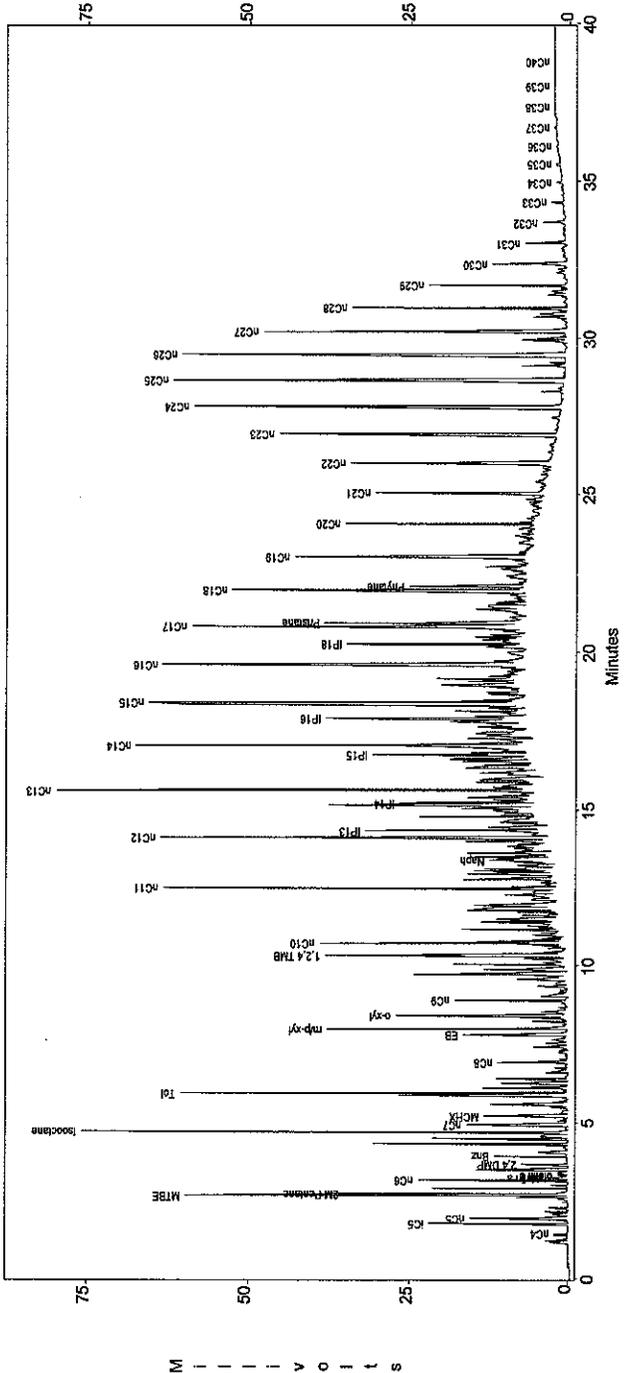
c:\ezchrom\chrom1\10099\gad\wax2 - Channel A



c:\ezchrom\chrom1\10099\gad\wax2 - Channel A



c:\ezchrom\chrom1\10099\gad\wax2 - Channel A



Torkelson Geochemistry, Inc.					
Density Measurements					
Paar DMA 512 / DMA 60		ASTM Method 4052			
Sample	Density gm/ml	Temp. of Measurement	Job Number	Date	
C-143	0.8676	60F	10099	7/20/10	
S-282	0.8104	60F	10099	7/20/10	
S-285	0.8921	60F	10099	7/20/10	
S-297	0.8229	60F	10099	7/20/10	
S-313	0.8694	60F	10099	7/20/10	
S-315	0.8552	60F	10099	7/20/10	



Torkelson Geochemistry, Inc.

2528 S. Columbia Place
Tulsa, OK 74114-3233

Phone: 918-749-8441 e-mail: BTorkelson@aol.com
Fax: 918-749-6005

CHAIN-OF-CUSTODY RECORD

Project: Sun- Philadelphia Refinery COA
Location: Philadelphia, PA

Report/Bill To: Colleen Costello
Address: 30 South 17th St, Suite 1500
Philadelphia, PA 19103

Proj. No.:

P.O.:

Sampled By: M. Brad Sparncake & Tim Delk

Phone: 215.864.0640

Fax: 215.864.0671

e-mail:

Additional Instructions

Requested Turn-Around Time:

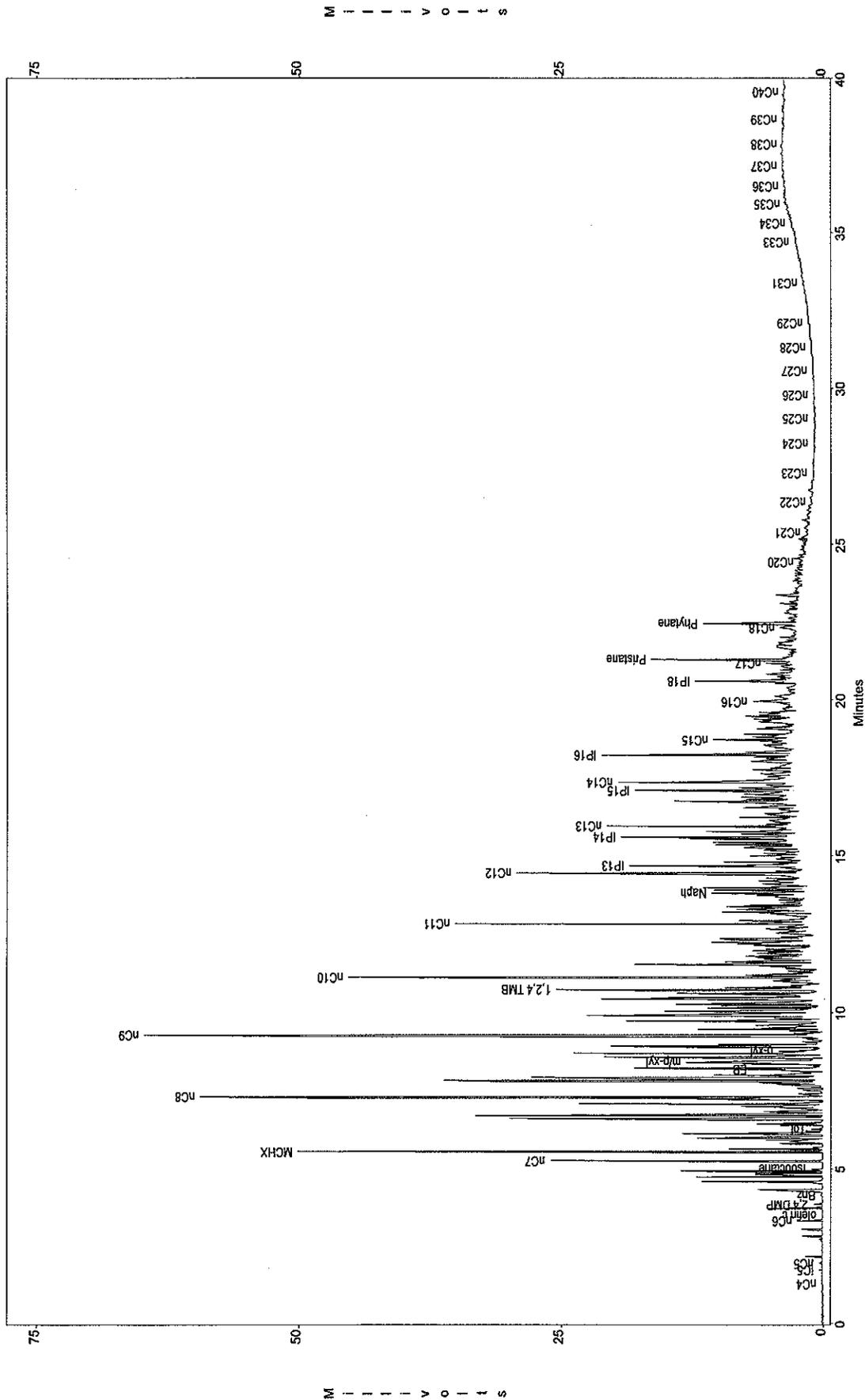
ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # of Vials	PRESERVATIVES	ANALYSES REQUESTED										REMARKS							
							GC Characterization	Specific Gravity																
1	B-130	2/27/04	Product		1	None	XX																	
2	A-14	↓	↓		1		XX																	
3	SRTE MW-1	↓	↓		1		XX																	
4	B-129	↓	↓		1		XX																	
5	WP 9-2	3/1/04			1		XX																	
6	BE-107	↓	↓		1		XX																	
7	S-33	↓	↓		1		XX																	
8	BF-100	↓	↓		1		XX																	
9	A-22	↓	↓		1		XX																	
10	S-100	↓	↓		1		XX																	

RELINQUISHED BY	ACCEPTED BY	DATE	TIME
<i>M. Brad Sparncake</i>	<i>Fed Ex</i>	3/1/04	
<i>Tim Delk</i>	<i>M. Brad Sparncake</i>	3-1-04	1705

003 -
003 -

Sun - Philadelphia Refinery COA
Sample ID : BF-106
Acquired : Mar 07, 2004 18:06:23

c:\ezchrom\chrom\040406\bf-106 -- Channel A

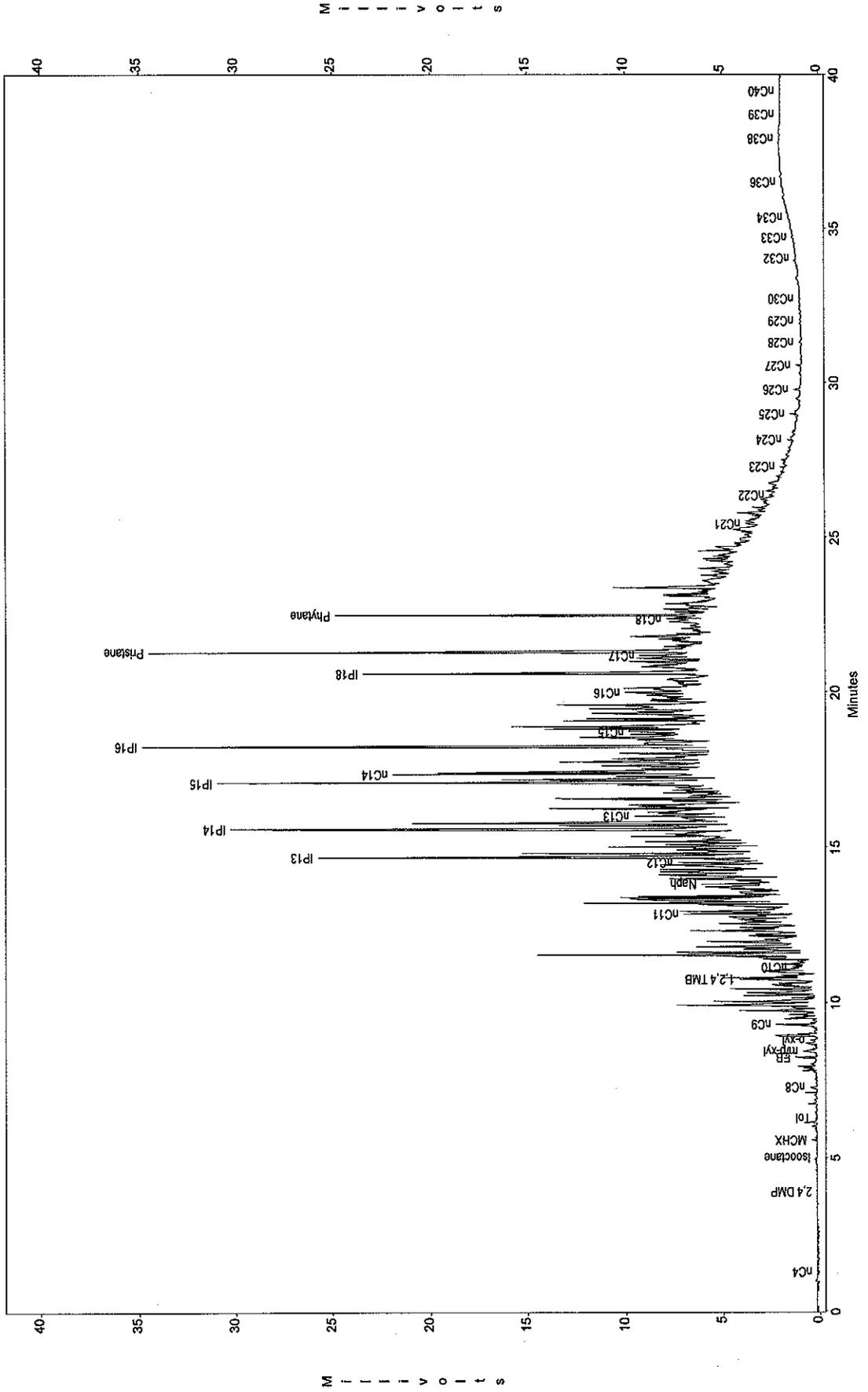


M I I I I V O I I S

M I I I I V O I I S

Sun - Philadelphia Refinery COA
Sample ID : BF-107
Acquired : Mar 06, 2004 07:21:31

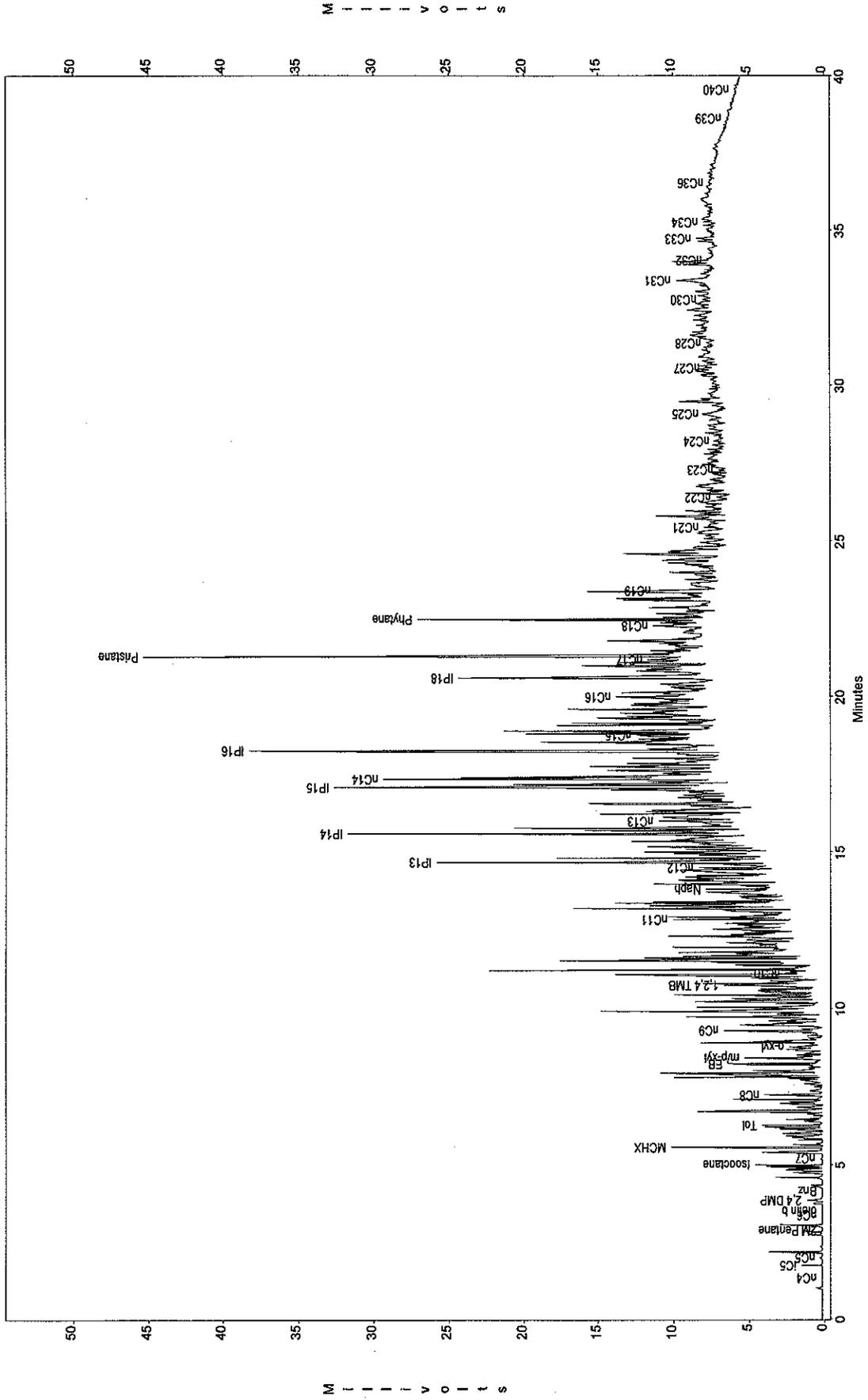
c:\ezchrom\chrom04046\bf-107 -- Channel A



M i n u t e s M i n u t e s

Sun - Philadelphia Refinery COA
Sample ID : S-21
Acquired : Mar 08, 2004 09:27:02

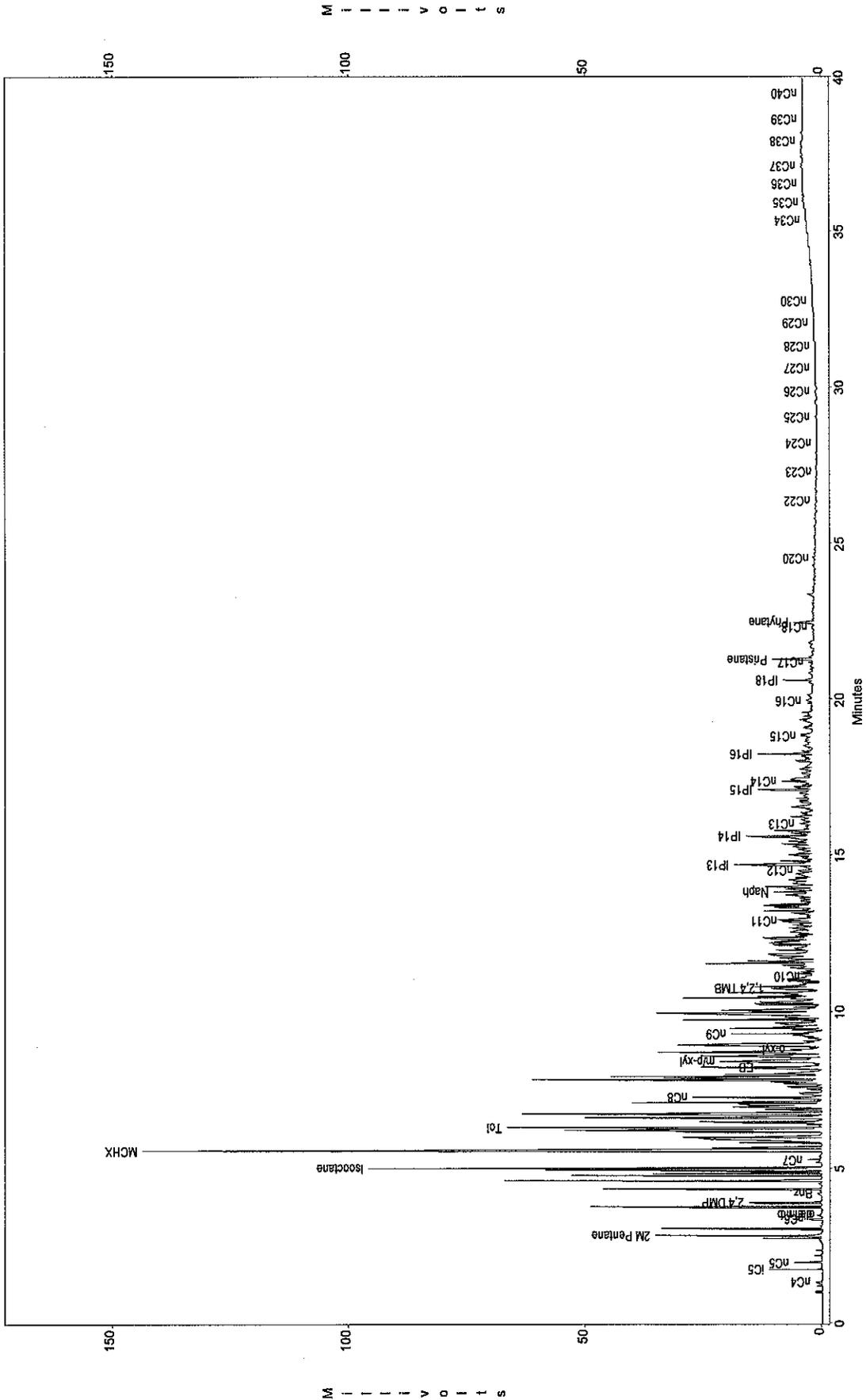
c:\ezchrom\chrom\040461s-21 - Channel A



M i i i i v o i i t s

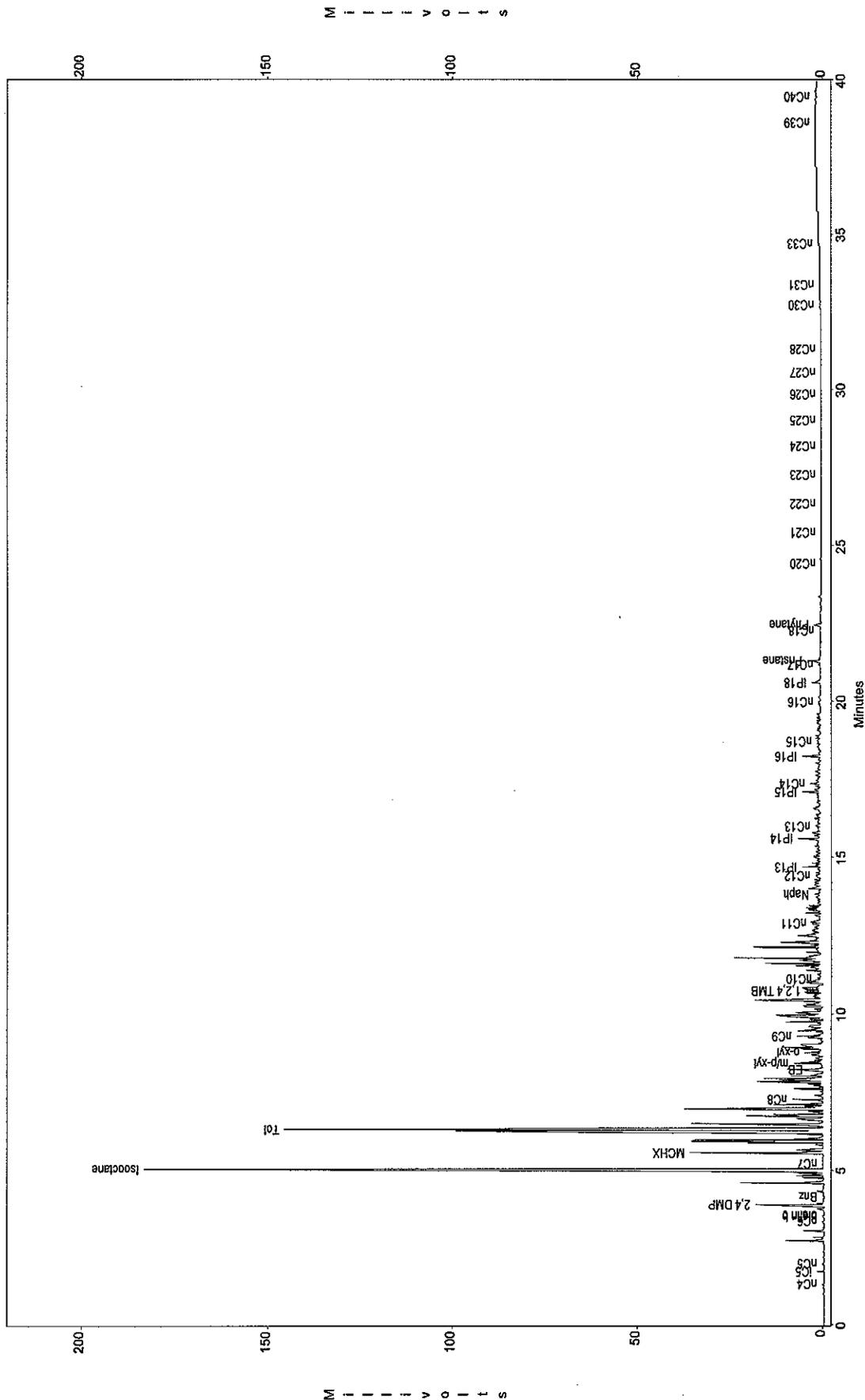
Sun - Philadelphia Refinery COA
Sample ID : S-59
Acquired : Mar 08, 2004 11:53:37

c:\ezchrom\chrom\040461s-59 - Channel A



Sun - Philadelphia Refinery COA
Sample ID : S-60
Acquired : Mar 06, 2004 13:54:31

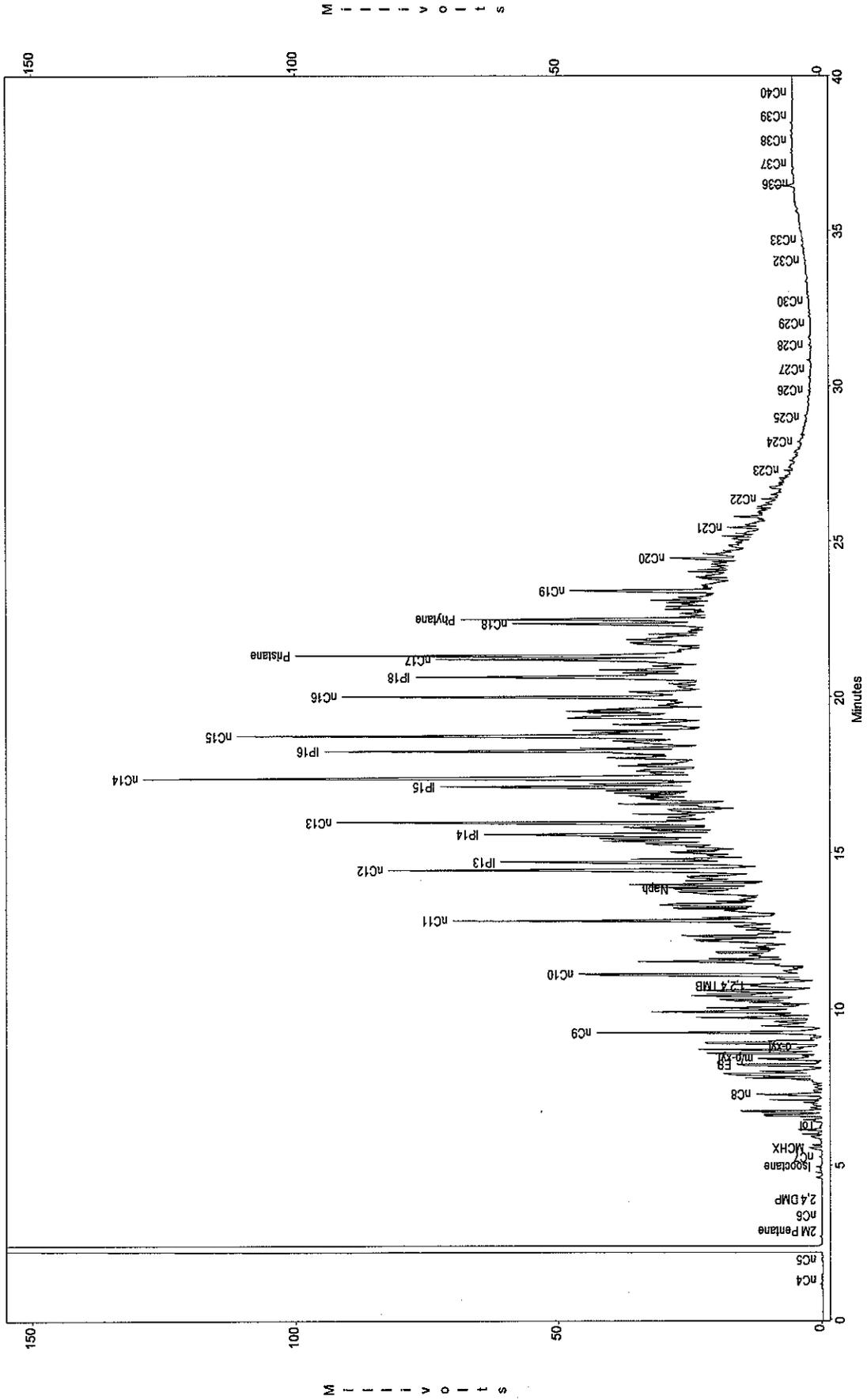
c:\ezchrom\chrom04046\6s-60.2 -- Channel A



M i n i t i v o l i t s

Sun - Philadelphia Refinery COA
Sample ID : S-68 Pad
Acquired : Mar 09, 2004 13:21:33

c:\ezchrom\chrom\04046s-68pad.2 -- Channel A

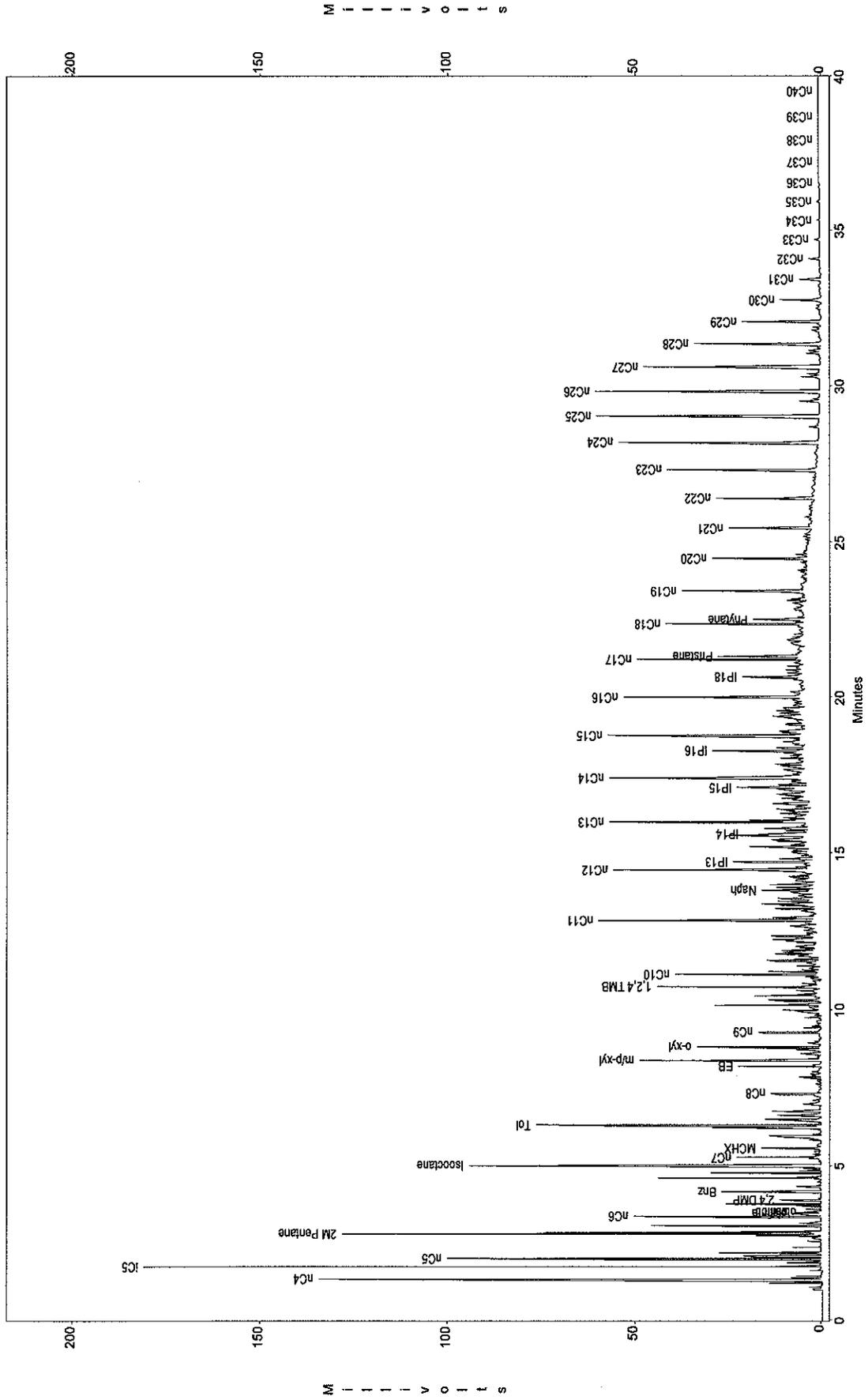


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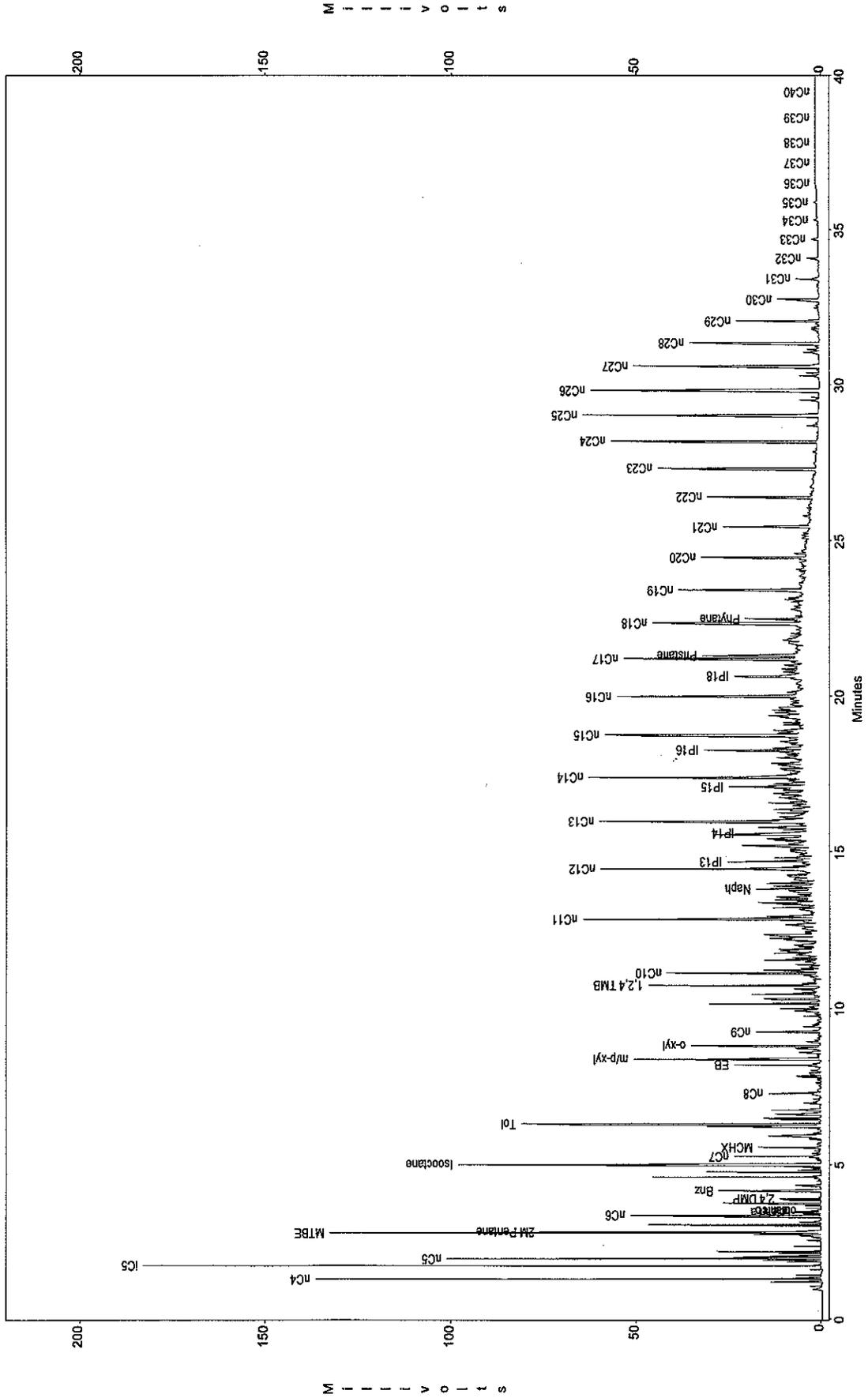
Sun - Philadelphia Refinery COA
Sample ID : Gas/Dies/Wax std
Acquired : Mar 05, 2004 10:14:50

c:\ezchrom\chrom\04046\gadiwax2 -- Channel A



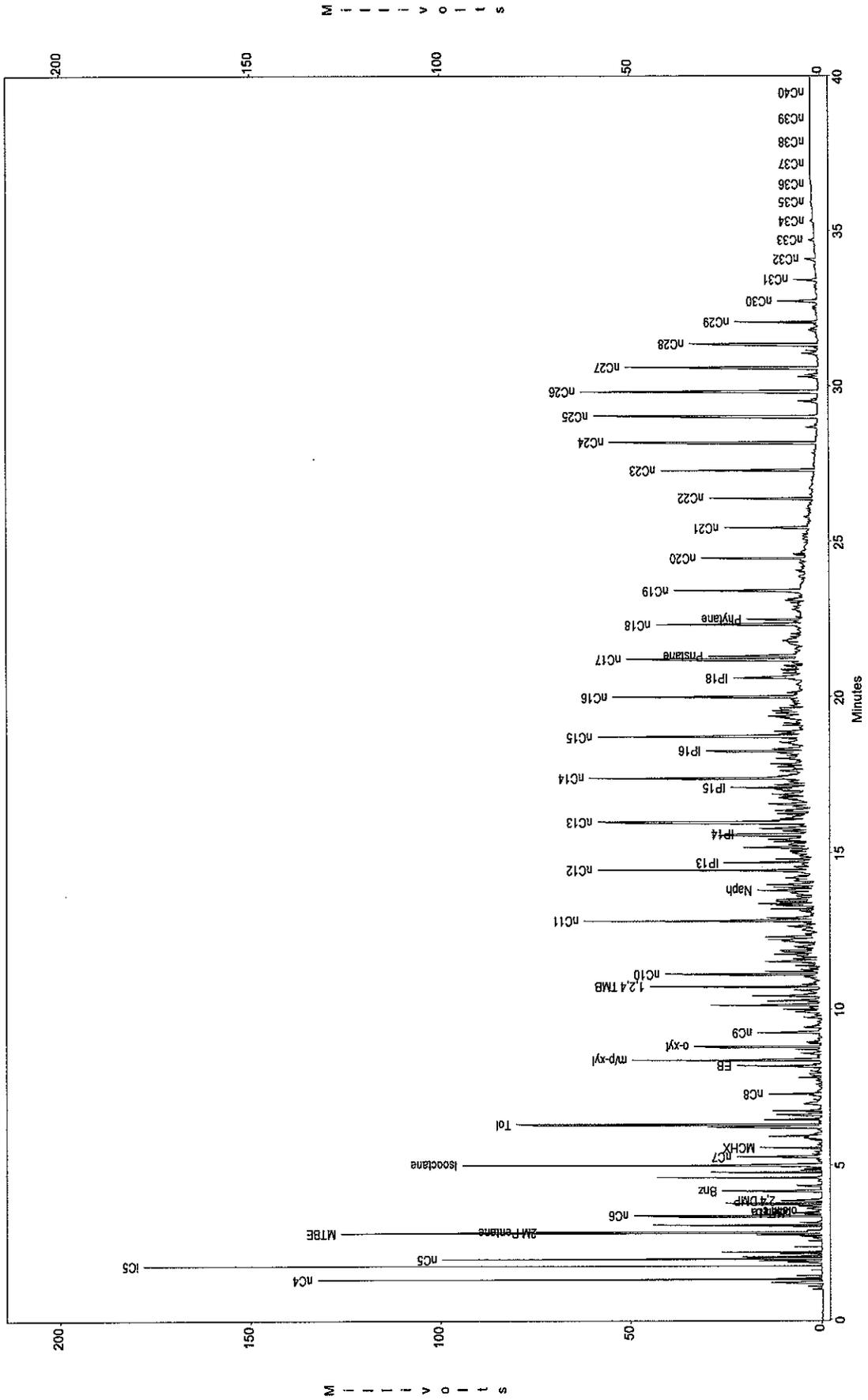
Sun - Philadelphia Refinery COA
Sample ID : Gas/Dies/Wax std
Acquired : Mar 06, 2004 11:29:07

c:\ezchrom\chrom04048\gadlwax2.2 -- Channel A



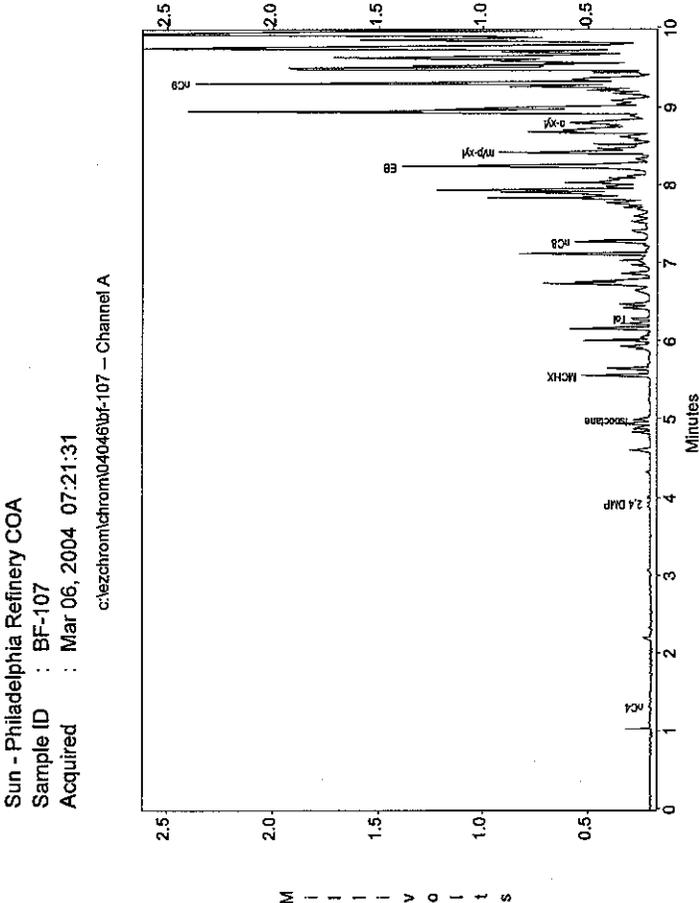
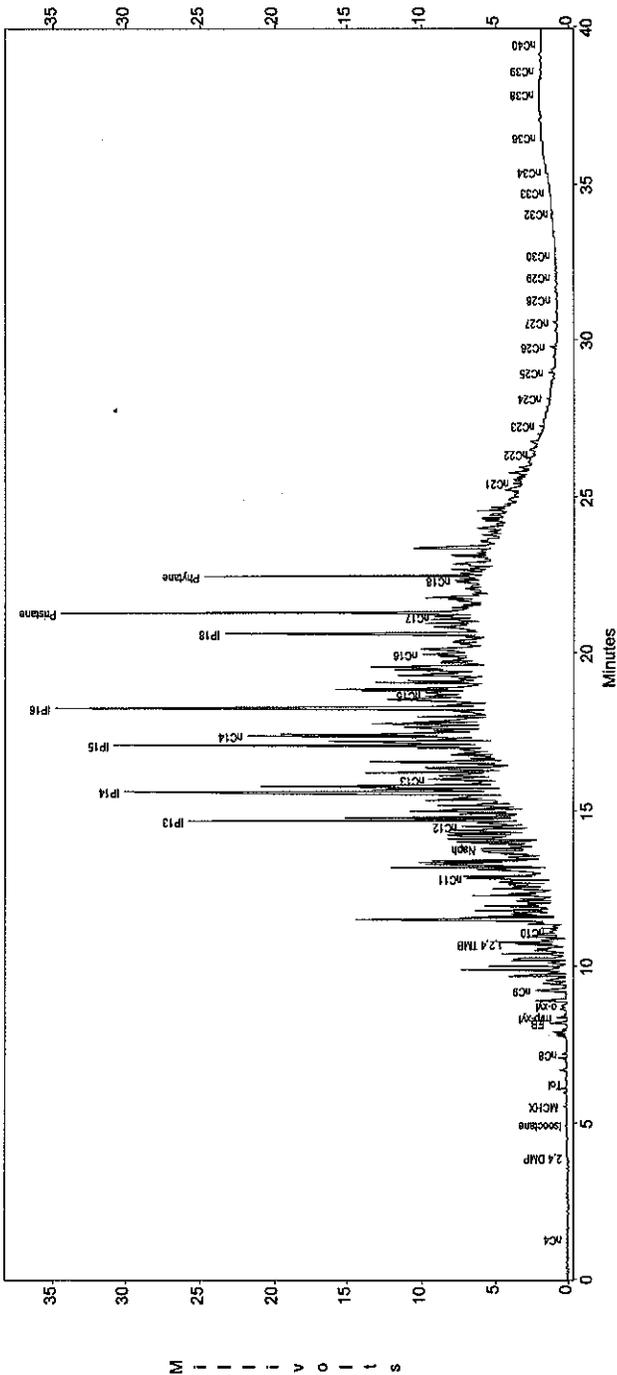
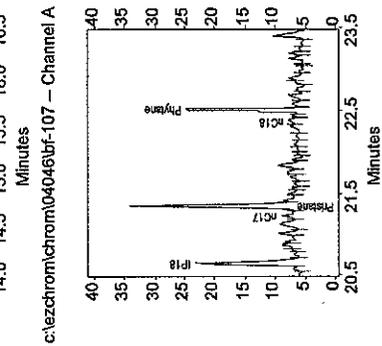
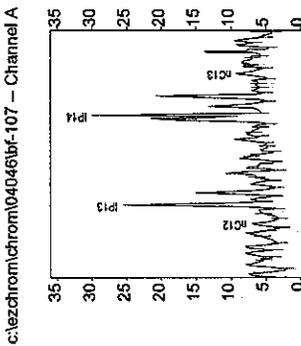
Sun - Philadelphia Refinery COA
Sample ID : Gas/Dies/Wax std
Acquired : Mar 07, 2004 16:27:47

c:\ezchrom\chrom04046\gadlwax2.3 - Channel A



Channel A Results

Peak	Area	Height
nc4	13	12
nc5	0	0
nc6	0	0
nc7	0	0
nc8	0	0
nc9	0	0
nc10	0	0
nc11	0	0
nc12	0	0
nc13	0	0
nc14	0	0
nc15	0	0
nc16	0	0
nc17	0	0
nc18	0	0
nc19	0	0
nc20	0	0
nc21	0	0
nc22	0	0
nc23	0	0
nc24	0	0
nc25	0	0
nc26	0	0
nc27	0	0
nc28	0	0
nc29	0	0
nc30	0	0
nc31	0	0
nc32	0	0
nc33	0	0
nc34	0	0
nc35	0	0
nc36	0	0
nc37	0	0
nc38	0	0
nc39	0	0
nc40	0	0



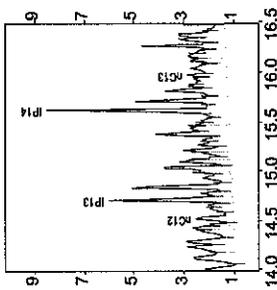
Sun - Philadelphia Refinery COA
 Sample ID : BF-107
 Acquired : Mar 06, 2004 07:21:31
 c:\ezchrom\chrom04046\bf-107 - Channel A

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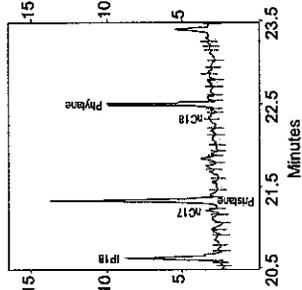
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Channel A Results

c:\ezchrom\chrom04046\c-65 -- Channel A



c:\ezchrom\chrom04046\c-65 -- Channel A

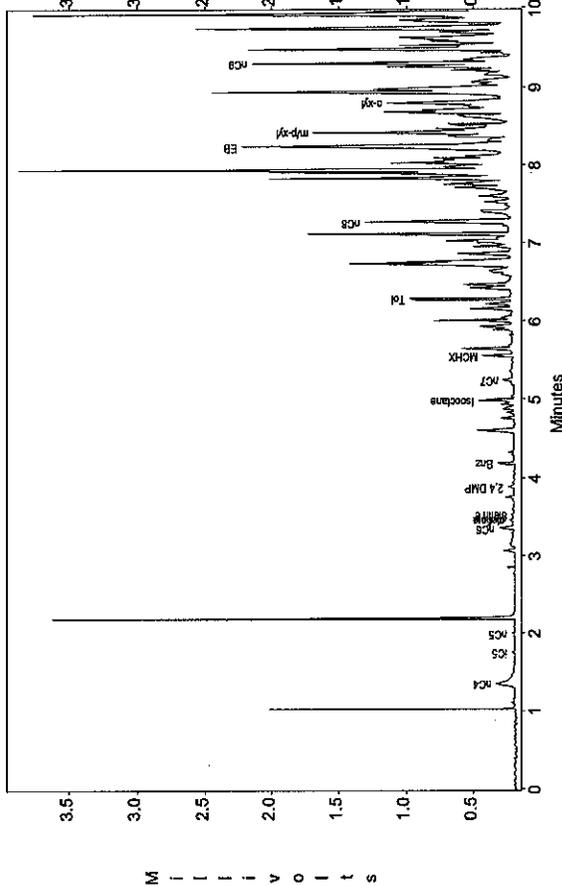


Sun - Philadelphia Refinery COA

Sample ID : C-65

Acquired : Mar 07, 2004 17:16:51

c:\ezchrom\chrom04046\c-65 -- Channel A



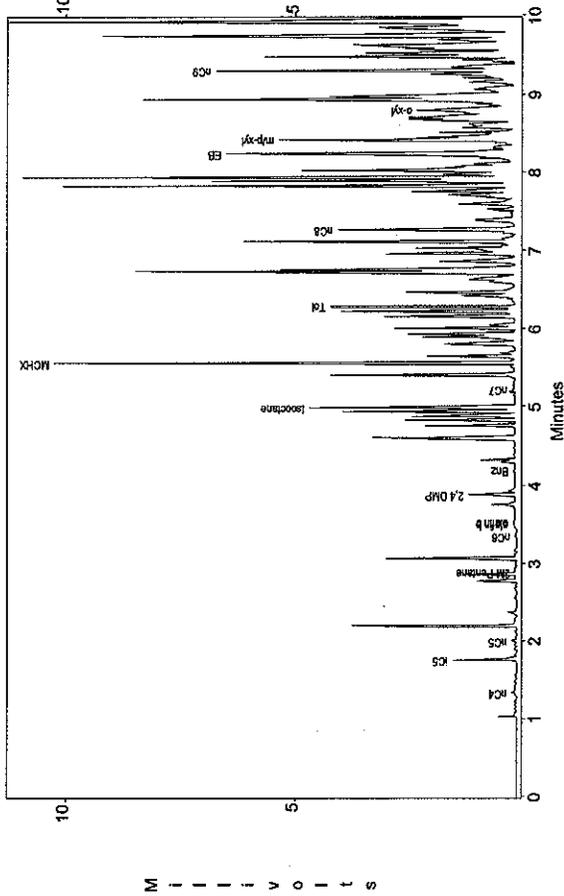
Channel A Results

Sun - Philadelphia Refinery COA

Sample ID : S-21

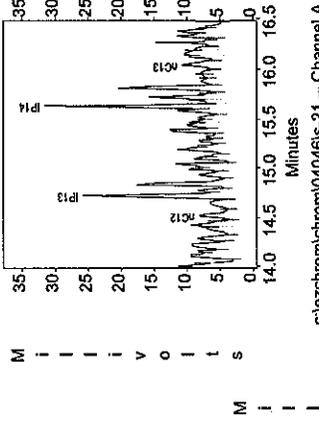
Acquired : Mar 08, 2004 09:27:02

c:\ezchrom\chrom04046\is-21 - Channel A



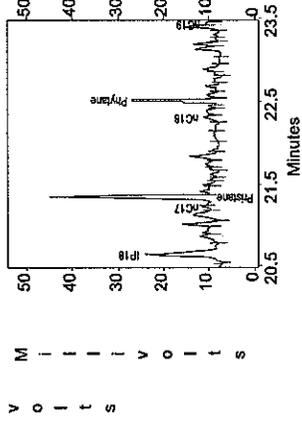
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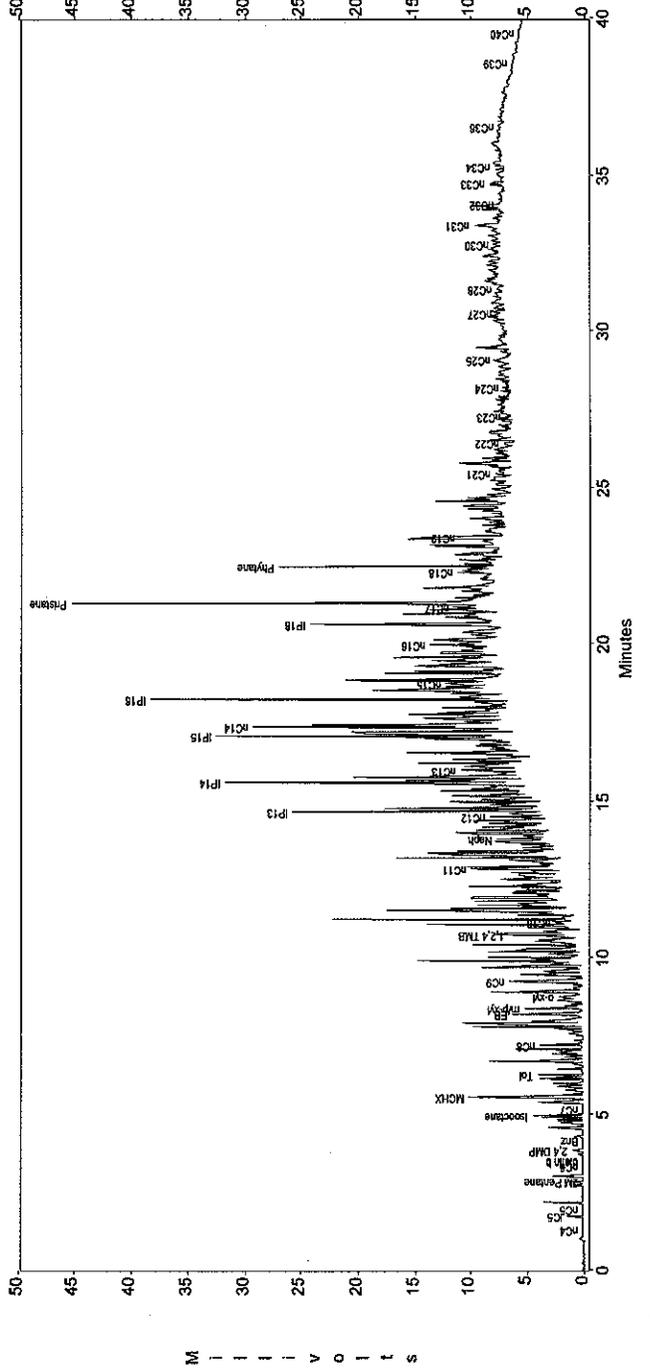
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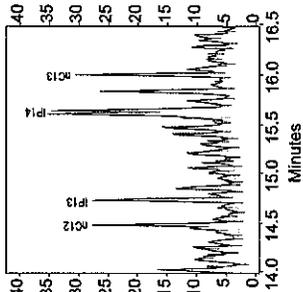


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Peak	Area	Height
nC4	68	79
nC5	1109	1379
nC6	97	112
nC7	0	0
nC8	30	15
nC9	32	28
nC10	0	0
nC11	68	55
nC12	72	60
nC13	1162	1042
nC14	5320	4503
nC15	12322	10100
nC16	5090	4051
nC17	5915	3874
nC18	10184	6886
nC19	7662	5176
nC20	3804	2132
nC21	9938	6528
nC22	12471	6271
nC23	3017	1855
nC24	14161	7904
nC25	11853	5132
nC26	13991	5067
nC27	38329	22346
nC28	42474	27537
nC29	22167	6485
nC30	52339	27002
nC31	54414	23440
nC32	57130	31425
nC33	19283	5014
nC34	12229	5222
nC35	56444	16857
nC36	11370	4368
nC37	96055	38024
nC38	13918	4291
nC39	43495	20030
nC40	9386	4360
nC41	0	0
nC42	2721	1366
nC43	4460	904
nC44	785	432
nC45	2976	731
nC46	9455	1463
nC47	0	0
nC48	0	0
nC49	2068	872
nC50	2100	556
nC51	0	0
nC52	1392	562
nC53	5122	1695
nC54	235	0
nC55	3317	1087
nC56	1060	632
nC57	0	0
nC58	318	155
nC59	0	0
nC60	0	0
nC61	498	133
nC62	0	0
nC63	400	124

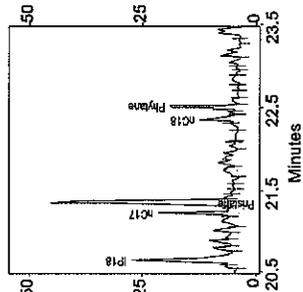
Channel A Results

c:\ezchrom\chrom\04046\is-29 - Channel A



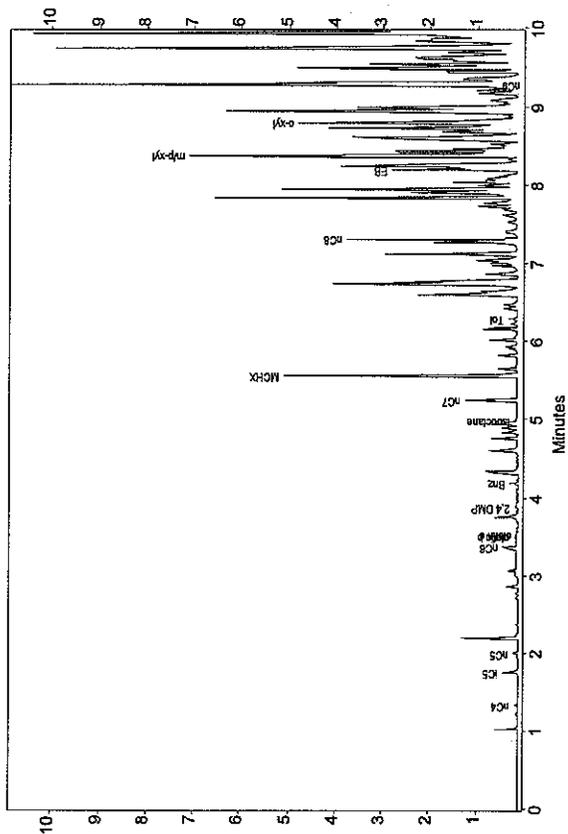
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c:\ezchrom\chrom\04046\is-29 - Channel A

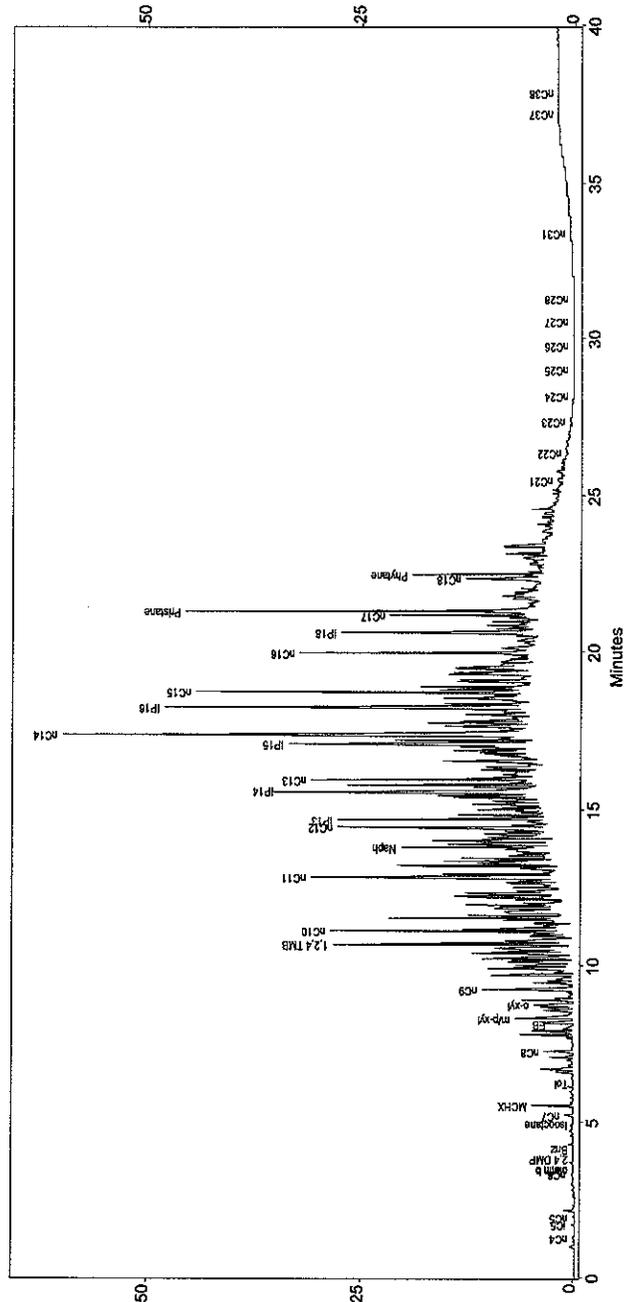


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c:\ezchrom\chrom\04046\is-29 - Channel A



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Sun - Philadelphia Refinery COA

Sample ID : S-29

Acquired : Mar 06, 2004 21:24:57

c:\ezchrom\chrom\04046\is-29 - Channel A

Channel A Results

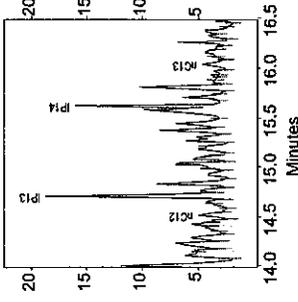
Peak Area Height

Peak	Area	Height
NC4	51	71
NC5	262	327
NC5	85	97
NPB	0	0
2N	333	324
Pentane	0	0
olefin a	0	0
olefin b	42	37
olefin c	32	24
2,4 DHP	66	55
Bnz	191	150
Isooctane	1288	1117
NC7	5965	4958
MCHX	306	187
Tol	4509	3625
NCB	3816	2696
EB	9689	6981
m/p-xy1	7407	4653
o-xy1	15844	10735
NC9	44639	27982
1,2,4 THB	43392	28274
NC10	45001	29197
NC11	30031	17506
Naph	37257	24833
NC12	36822	24531
IP13	44656	30086
IP14	38615	25236
NC13	47098	29209
IP15	107065	55460
NC14	80262	42892
IP16	68663	38177
NC15	50647	27023
IP18	65432	23201
NC17	34291	17543
Pristane	95533	41540
NC18	20251	8806
NC19	31665	15281
NC20	0	0
NC21	2489	555
NC22	317	166
NC23	205	86
NC24	246	39
NC25	250	40
NC26	138	50
NC27	128	45
NC28	59	30
NC29	0	0
NC30	0	0
NC31	173	27
NC32	0	0
NC33	0	0
NC34	0	0
NC35	0	0
NC36	0	0
NC37	142	31
NC38	27	15
NC39	0	0
NC40	0	0

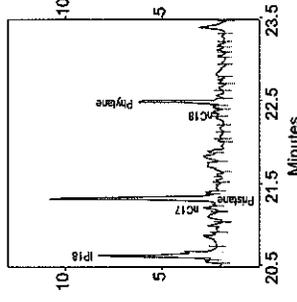
Channel A Results

Peak	Area	Height
nc4	796	1253
ICS	8790	11308
nc5	5003	6081
MTBE	0	0
2M Pentane	33578	35340
nc6	2779	2698
olefin a	0	0
olefin b	1010	961
olefin c	718	564
2,4 DNP	16845	15499
Bnz	1277	960
Isooctane	127550	95750
nc7	3902	2951
MCHX	215014	143720
Tol	88911	66356
nc8	38664	27230
EB	11901	1321
m/p-xy1	30634	21454
o-xy1	14906	6722
nc9	29253	19131
nc9	16425	10313
1,2,4 TMB	0	0
nc10	7657	2660
nc11	12486	6585
Naph	13669	8513
nc12	6475	2800
IP13	25912	16556
IP14	19794	13845
nc13	6951	2380
IP15	15913	10976
nc14	11395	6228
IP16	19616	11600
nc15	4060	2371
nc16	6206	1428
IP18	17152	6413
nc17	1893	956
Prisatane	19794	8959
nc18	1829	422
Phyrene	9314	4515
nc19	0	0
nc20	846	342
nc21	0	0
nc22	551	102
nc23	159	88
nc24	999	140
nc25	1169	175
nc26	418	120
nc27	637	72
nc28	243	55
nc29	406	80
nc30	266	81
nc31	0	0
nc32	0	0
nc33	0	0
nc34	515	129
nc35	170	73
nc36	309	68
nc37	237	58
nc38	48	16
nc39	443	80
nc40	860	115

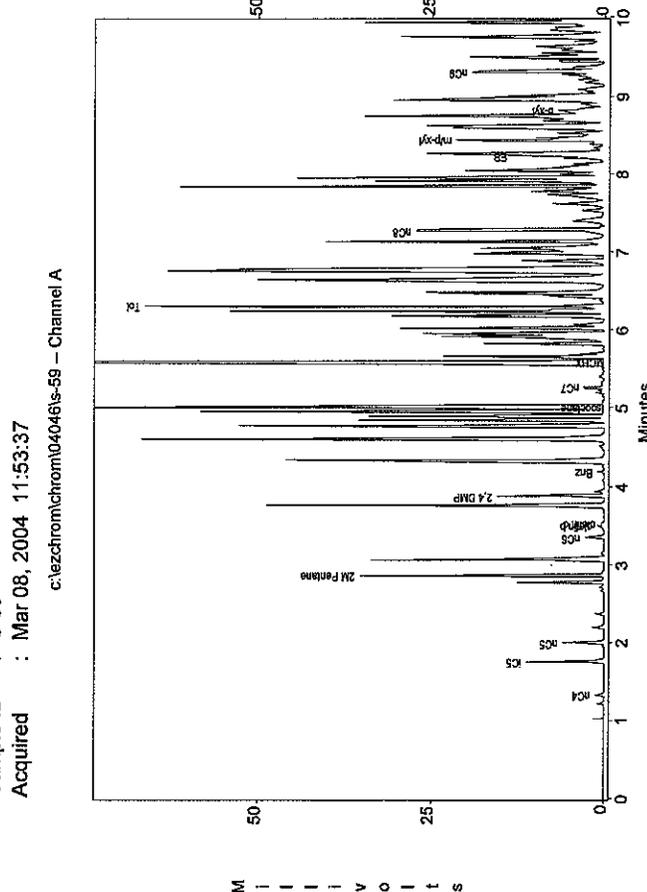
c:\ezchrom\chrom04046\5-59 - Channel A



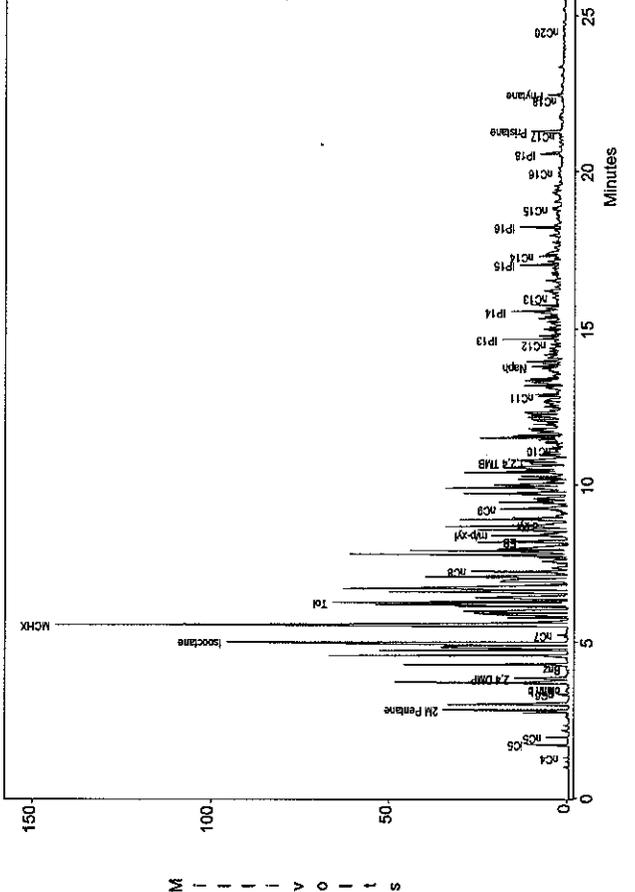
c:\ezchrom\chrom04046\5-59 - Channel A



c:\ezchrom\chrom04046\5-59 - Channel A



c:\ezchrom\chrom04046\5-59 - Channel A



Sun - Philadelphia Refinery COA
 Sample ID : S-59
 Acquired : Mar 08, 2004 11:53:37

c:\ezchrom\chrom04046\5-59 - Channel A

c:\ezchrom\chrom04046\5-59 - Channel A

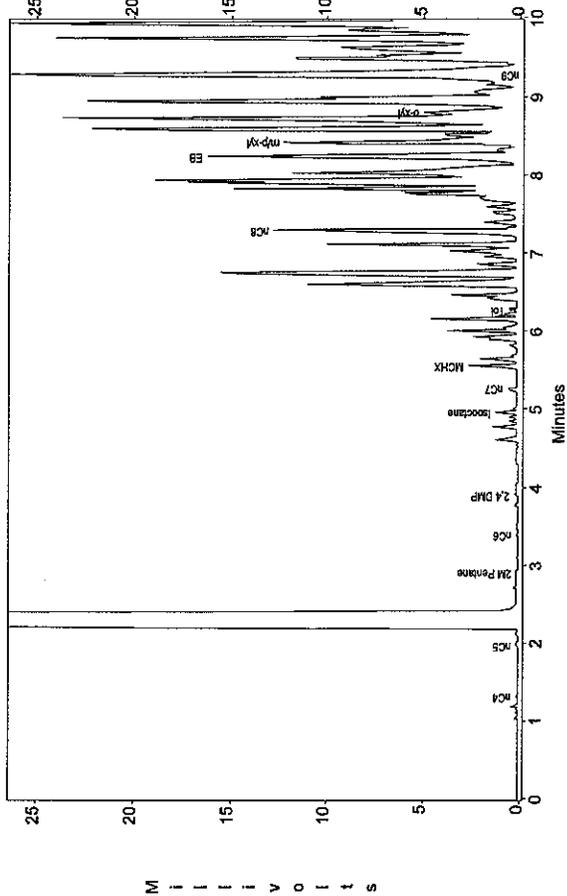
Channel A Results

Sun - Philadelphia Refinery COA

Sample ID : S-68 Pad

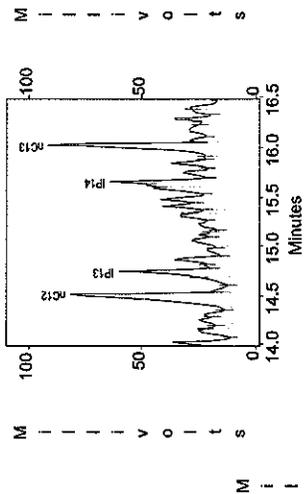
Acquired : Mar 09, 2004 13:21:33

c:\ezchrom\chrom\040461s-68pad.2 - Channel A

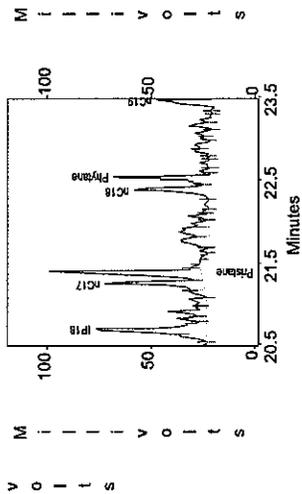


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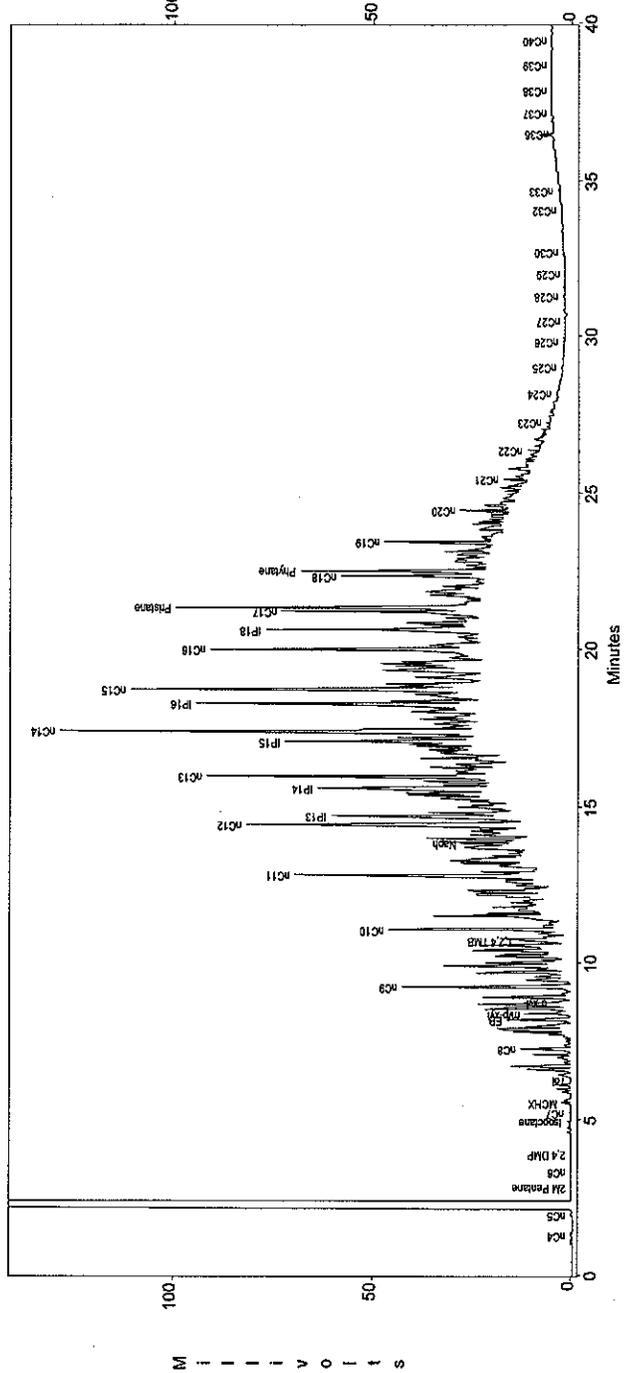


c:\ezchrom\chrom\040461s-68pad.2 - Channel A



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c:\ezchrom\chrom\040461s-68pad.2 - Channel A



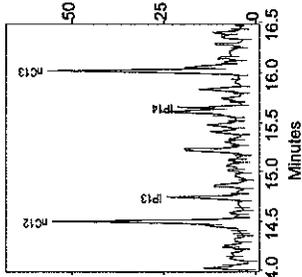
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Peak	Area	Height
nC4	41	23
nC5	0	0
nC6	97	39
MCHX	0	0
2M Pentane	50	44
nC7	27	25
nC8	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	148	117
Ben	0	0
Isooctane	1802	1110
nC9	723	498
MCHX	4121	2543
Tol	663	357
nC10	23710	12610
nC11	48420	15964
m/p-xy1	30284	11996
EB	16235	4665
nC12	125600	42495
nC13	49594	12099
1,2,4 TMB	134641	43947
nC14	195930	63121
nC15	49059	18664
nC16	177272	70866
nC17	138784	48932
IP18	104878	49727
nC18	252811	76722
nC19	168029	49973
nC20	345005	104221
nC21	186438	67623
nC22	309322	87692
nC23	206115	65138
IP18	201010	53708
nC24	141902	48292
Pyrene	335075	74130
nC25	117898	37367
nC26	150983	47849
nC27	115791	29314
nC28	33859	12849
nC29	11676	6143
nC30	6997	3064
nC31	3512	1498
nC32	3229	785
nC33	3163	427
nC34	532	220
nC35	1150	265
nC36	1546	523
nC37	210	57
nC38	273	93
nC39	0	0
nC40	139	83
	729	191
	0	0
	0	0
	124	45
	314	138
	268	79
	88	47
	1044	109

Channel A Results

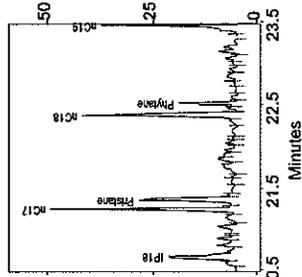
Peak	Area	Height
NC4	76324	134418
ICS	125697	181328
NC5	73607	100180
NTB5	0	0
2H Pentane	125682	126303
NC6	50948	50159
olefin a	9257	8012
olefin b	7096	7246
olefin c	5741	5209
2,4 DNP	11717	11007
Bnz	34021	27022
Isooctane	131604	94025
NC7	28641	22911
MCHX	20811	16246
Tol	125346	76234
NC8	17073	13806
EB	30382	22407
m/p-xyI	78762	48711
o-xyI	47102	33207
NC9	24070	16777
1,2,4 TMB	72129	43739
NC10	57840	39063
NC11	103371	58108
Naph	25460	14283
NC12	89711	53298
IP13	35566	21510
IP14	24622	17633
NC13	89976	52606
IP15	36521	19016
NC14	125559	52513
IP16	45684	24554
NC15	106204	52753
NC16	106353	48603
IP18	48327	16426
NC17	84413	44714
Prisatane	51017	23726
NC18	67604	37326
Phyane	29173	14070
NC19	63991	34390
NC20	46362	25707
NC21	38755	22106
NC22	48811	26567
NC23	76713	39872
NC24	117301	53494
NC25	138486	59360
NC26	142113	60095
NC27	109196	47455
NC28	68480	33913
NC29	28149	20797
NC30	28512	10921
NC31	10070	5608
NC32	5237	2932
NC33	2822	1643
NC34	1556	907
NC35	803	499
NC36	479	261
NC37	285	129
NC38	200	75
NC39	115	45
NC40	84	27

c:\ezchrom\chrom04046\gadwax2 - Channel A



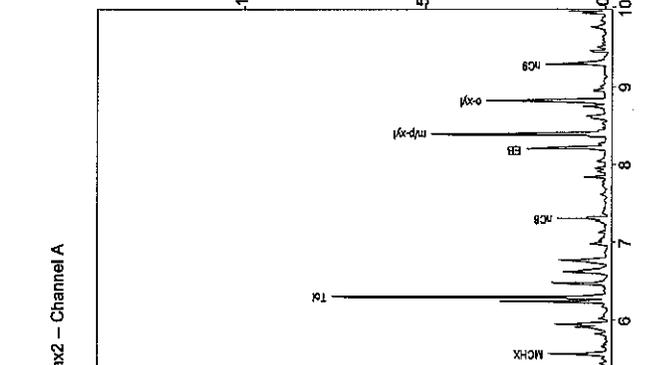
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c:\ezchrom\chrom04046\gadwax2 - Channel A



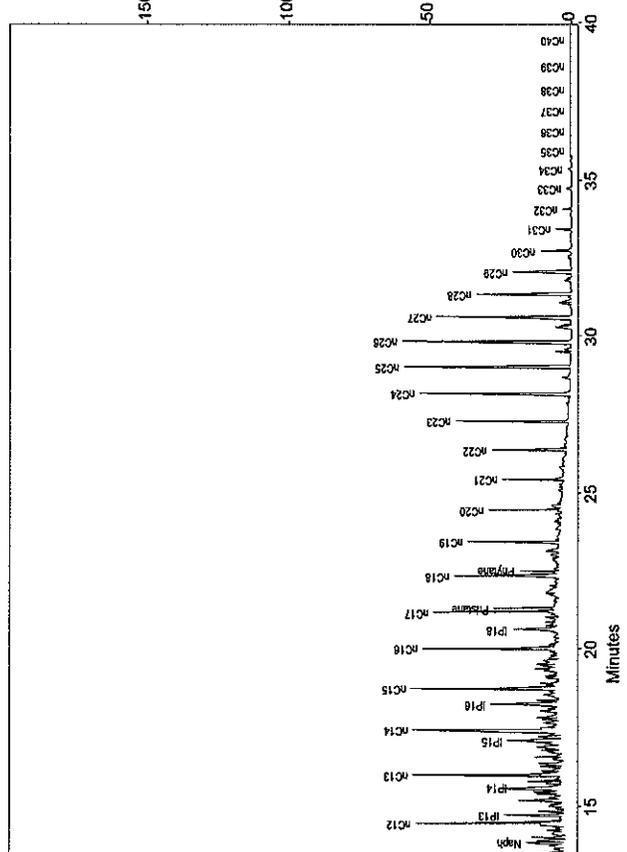
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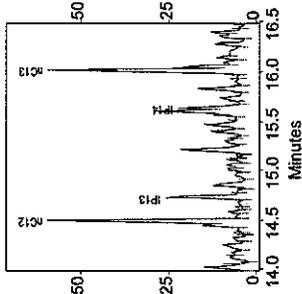
Sun - Philadelphia Refinery COA
 Sample ID : Gas/Dies/Wax std
 Acquired : Mar 05, 2004 10:14:50

c:\ezchrom\chrom04046\gadwax2 - Channel A

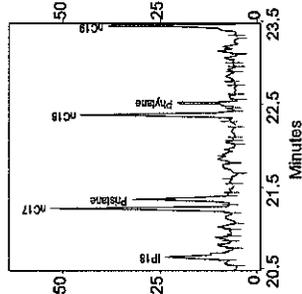
Channel A Results

Peak	Area	Height
nc4	77458	136558
nc5	128744	183286
nc6	75326	101085
MTBE	126144	132765
2M Pentane	69925	75907
nc6	52780	51587
olefin a	9581	8348
olefin b	7328	7361
olefin c	5995	5340
2,4 DMP	12106	11305
Bnz	35354	27900
Isocetane	137200	98040
nc7	30024	23818
MCHX	21837	17163
Tol	130835	81258
nc8	18106	14621
EB	32373	23606
m/p-xy1	84188	50805
o-xy1	49868	34944
nc9	28694	17851
1,2,4 TH8	73652	45692
nc10	61839	41682
nc11	111185	62682
Naph	27486	15061
nc12	96922	57306
IP13	30469	23100
IP14	24187	17833
nc13	101176	56029
IP15	42255	21856
nc14	142941	59197
IP16	54663	27834
nc15	114595	54351
nc16	114660	50580
IP18	56958	18729
nc17	92736	47895
Pristane	54886	26808
nc18	75561	40240
Phytane	31599	15655
nc19	70996	33254
nc20	52053	28326
nc21	40971	23744
nc22	52801	28682
nc23	83935	42583
nc24	128314	55075
nc25	150243	63886
nc26	153225	61778
nc27	117341	50227
nc28	74472	35364
nc29	40653	22328
nc30	20232	11478
nc31	10756	6096
nc32	5612	3324
nc33	3034	1777
nc34	1676	946
nc35	900	547
nc36	560	286
nc37	374	159
nc38	201	82
nc39	149	57
nc40	114	35

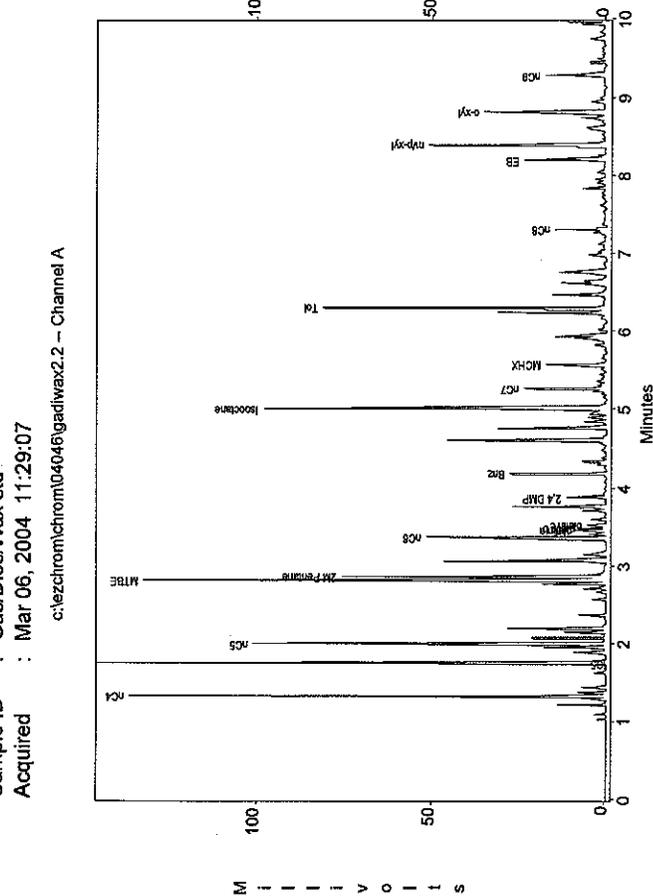
c:\ezchrom\chrom04046\gadiwax2.2 - Channel A



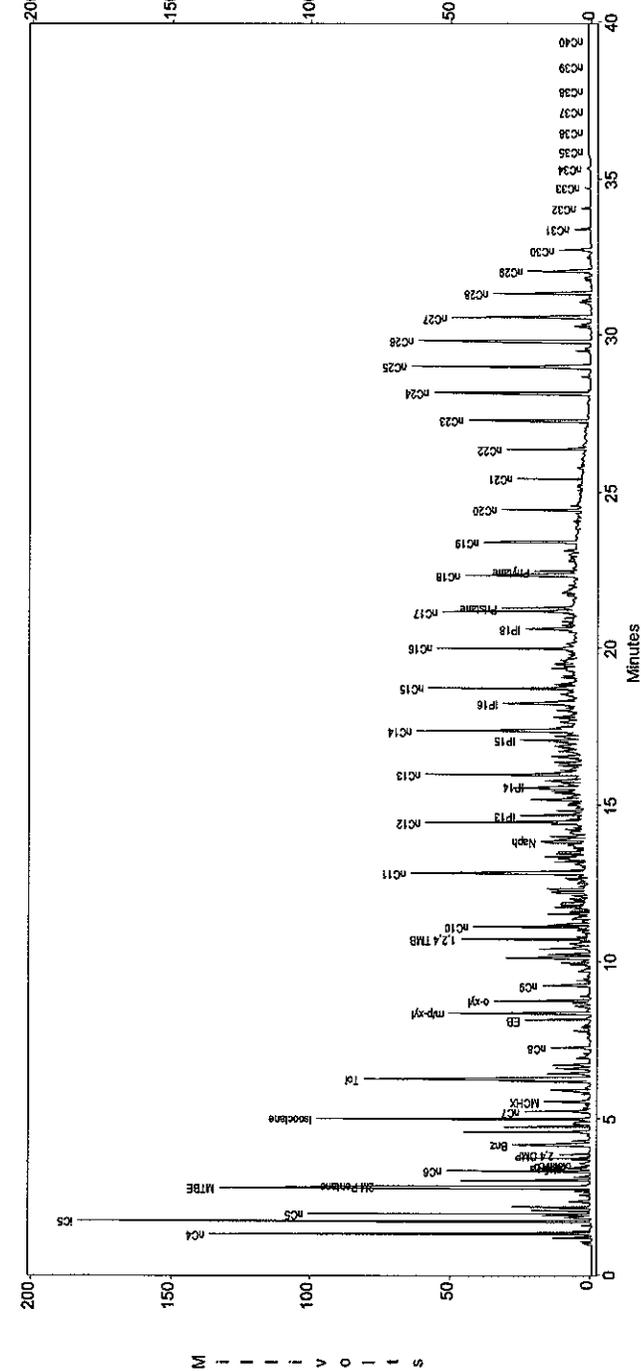
c:\ezchrom\chrom04046\gadiwax2.2 - Channel A



c:\ezchrom\chrom04046\gadiwax2.2 - Channel A



c:\ezchrom\chrom04046\gadiwax2.2 - Channel A



Sun - Philadelphia Refinery COA

Sample ID : Gas/Dies/Wax std

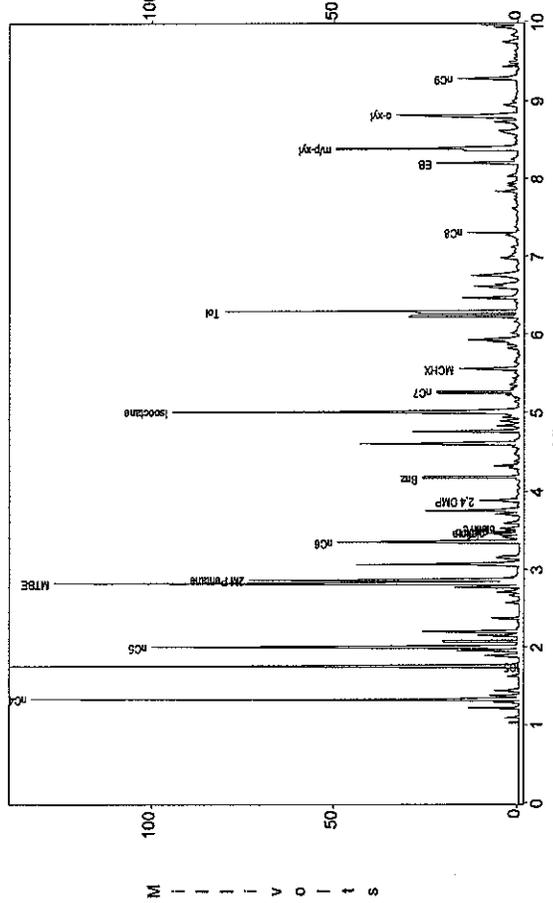
Acquired : Mar 06, 2004 11:29:07

c:\ezchrom\chrom04046\gadiwax2.2 - Channel A

Channel A Results

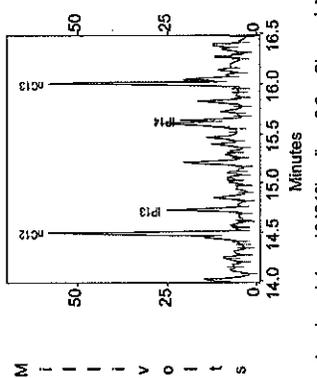
Sun - Philadelphia Refinery COA
 Sample ID : Gas/Dies/Wax std
 Acquired : Mar 07, 2004 16:27:47

c:\ezchrom\chrom04046\gadivax2.3 - Channel A

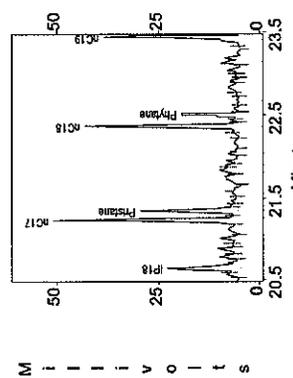


c:\ezchrom\chrom04046\gadivax2.3 - Channel A

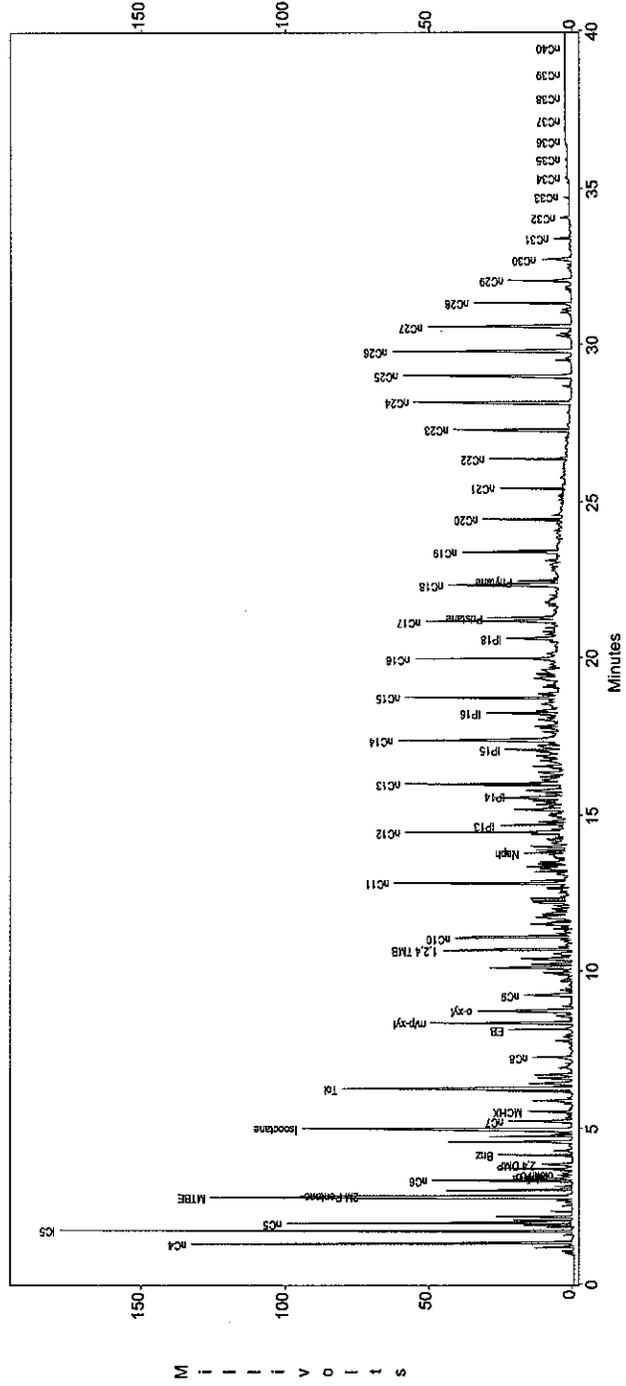
c:\ezchrom\chrom04046\gadivax2.3 - Channel A



c:\ezchrom\chrom04046\gadivax2.3 - Channel A



Peak	Area	Height
nC4	12277	132589
nC5	12289	178282
nC6	72111	59927
MTBE	120053	126296
2H Pentane	67309	73384
nC6	50110	49331
olefin a	9060	8035
olefin b	6897	6990
olefin c	5633	5095
2,4 DMP	11448	10863
Bnz	33610	26311
Isooctane	131090	94376
nC7	28665	28570
MCHX	20551	16158
Tol	124718	80339
nC8	17171	14000
EB	30742	22465
m/p-xy1	81647	48629
e-xy1	47338	33265
nC9	27340	17017
1,2,4 THB	70944	44193
nC10	59484	40762
nC11	107019	60555
naph	26987	15282
nC12	93349	56667
IP13	37261	22961
IP14	23534	17207
nC13	97647	55033
IP15	40713	20552
nC14	137643	57277
IP16	52746	26623
nC15	110085	54657
nC16	115273	50330
IP18	54821	18200
nC17	98744	46155
Prisane	52604	24413
nC18	72412	38407
Phyane	30125	14657
nC19	71773	34120
nC20	49409	27517
nC21	39259	22382
nC22	50700	27374
nC23	79711	40253
nC24	121096	54615
nC25	142086	58736
nC26	145134	62459
nC27	111856	50452
nC28	70506	33745
nC29	38493	21488
nC30	19827	10452
nC31	10144	5823
nC32	5288	3046
nC33	2883	1634
nC34	1617	885
nC35	828	504
nC36	575	264
nC37	300	148
nC38	265	108
nC39	113	48
nC40	70	26



c:\ezchrom\chrom04046\gadivax2.3 - Channel A

Torkelson Geochemistry, Inc.

Density Measurements			
Paar DMA 512 / DMA 60		ASTM Method 4052	
Sample	Density gm/ml @ 60F	Job Number	Date
A-13	0.9015	04046	3/8/04
A-14	0.9143	04046	3/9/04
A-22	0.9356	04046	3/9/04
A-47	0.8926	04046	3/8/04
A-133	qns	04046	3/9/04
B-39	0.8734	04046	3/8/04
B-43	0.9161	04046	3/9/04
B-129	0.8645	04046	3/9/04
B-130	0.9306	04046	3/8/04
B-144	0.8654	04046	3/9/04
BF-106	0.8199	04046	3/9/04
BF-107	0.8671	04046	3/8/04
C-65	0.9162	04046	3/9/04
C-106	0.9306	04046	3/9/04
C-107	0.9371	04046	3/8/04
N-14	0.9299	04046	3/9/04
N-25	0.0402	04046	3/8/04
N-35	0.9205	04046	3/9/04
N-48	0.9049	04046	3/9/04
N-52	0.8613	04046	3/8/04
N-68	0.9211	04046	3/9/04
N-79	0.8169	04046	3/9/04
PZ-204	0.9016	04046	3/8/04
PZ-502	0.9155	04046	3/9/04
S-21	0.9281	04046	3/9/04
S-29	0.8550	04046	3/8/04
S-32	0.8665	04046	3/8/04
S-33	0.8578	04046	3/9/04
S-50	0.7508	04046	3/8/04
S-56	0.8684	04046	3/9/04
S-59	0.8039	04046	3/9/04
S-60	0.7898	04046	3/8/04
S-76	0.7851	04046	3/8/04
S-79	0.8406	04046	3/8/04
S-81	0.7948	04046	3/9/04
S-89	0.8523	04046	3/8/04
S-92	0.9156	04046	3/9/04
S-97	0.8653	04046	3/8/04
S-100	0.7930	04046	3/9/04
S-103	0.7978	04046	3/9/04
S-104	0.8787	04046	3/8/04
S-117	0.8236	04046	3/9/04
S-124	0.8223	04046	3/9/04
S-130	0.8623	04046	3/8/04
S-138	0.8957	04046	3/9/04
S-158	0.8692	04046	3/9/04
S-162	0.7498	04046	3/8/04
SRTF MW-1	0.7705	04046	3/9/04
West Yard W8	0.9121	04046	3/9/04

WP 9-2

0.8114

04046

3/9/04